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VIEWS, NEWS AND INTERVIEWS.

M. Trouve, the French electrician, has been turning his attention to the production of new storm effects in theatres. The old plan of making theatrical lightning was to flash lycopodium powder behind a zigzag line cut in the scenery. M. Trouve's new method consists in moving a long bamboo rod up and down in a zigzag direction and flashing a small incandescent lamp attached to the end of the rod. The flashing is done by starting and stopping the current with a commutator controlled by the foot. Very effective lightning is also made by rubbing together an old file and a piece of carbon which are attached to the end of wires connected to the lighting circuit. The sound of the wind in a storm is imitated by means of a double-action pump and two sirens, and that of hail by throwing coarse sand against a screen of osiers.

An electric power plant in Taunton, Mass., would undoubtedly handsomely reward the stockholders.

Professor Wiggins believes that telegraph wires cause drought, that the atmosphere cannot absorb moisture unless it is charged with electricity, and that upon an oblate spheroid like the earth the electricity will inevitably collect at the equator. In this way he explains the frequency of rains at the equator. "If, however," he says, "there be elevated spots on a sphere, electricity will collect on them. Should these spots or continents be connected by wires, it might accumulate on each alternately. This has happened this year, and America has all of the electric energy and Europe has lost it; so that our continent is flooded and Europe is burned up with drought." His conclusion from all this is that electric wires should be buried.

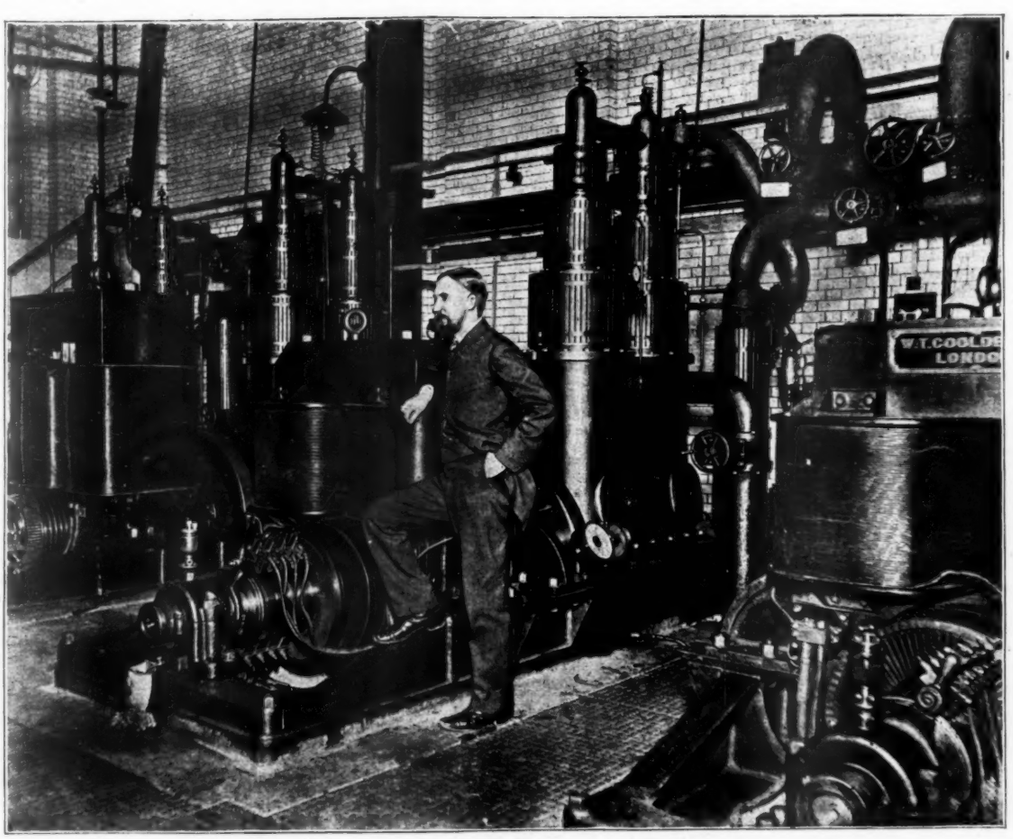
William B. Halsey, a lineman of the Postal Telegraph Cable Company, said in the Court of Special Sessions last week that it was all right for him to string a wire from 116 Mulberry street to No. 121, across the street, without a permit, because he was merely replacing an old wire. Andrew M. Cameron, of the Board of Electrical Control, did not agree with him. Neither did Justices Smith, Hogan and Divver, who fined him $50.

William Rook and about 30 others, of Cromwell, Pa., have brought suit for $100,000 damages against the New Jersey and Pennsylvania Concentrating Company, of which Thomas A. Edison is president. The suits are the result of the falling of a building which was under course of construction by the company at Edison, N. J., last August.

Probably the largest alternating current electric motor ever set up is being tested at the works of the Hartford Electric Light Company, at Hartford, Conn. It has 300 horse-power and requires 3,000 volts, reduced by transformers to 600 volts. The electricity is supplied by a giant dynamo at the Farmington dam. By means of the power developed by this motor a portion of the immense power of the Farmington Fall is transferred directly to that city.

It is rumored that the Germania Electric Company (re-organized) will commence business in the big factory on Maple street, at Marlboro, Mass., at a date not far distant.

It is stated, also, by those supposed to know, that Capt. de Khotinsky will not manage the manufacturing end of the new company's business. The two barriers against the success of the company—debts and an injunction of the Edison Company, or General Electric Company—now being removed, there seems nothing to debar the acquirement of every success expected to be attained when the people here parted with goodly sums of cash to brace up the concern's exchequer in the hope of benefiting the city at large. And should work be resumed, perhaps such hopes may be realized, also.



Prof. A. B. W. Kennedy, in the Millbank Street Station of the Westminster Company, London.

Success in Central Station Management.

BY PROF. A. B. W. KENNEDY, F. R. S.

[Interview in *Lightning*, London.]

In his lecture at the Royal Institution, Professor Kennedy declared that, while there was room for enormous improvement in plant efficiency and economy in the way of bringing all our machinery up to the highest level reached, it was much more difficult to make improvements above that level. A comparatively high efficiency has been attained in the working of boilers, but there are certain limitations, both thermal and practical, which make it improbable that we shall ever get more than a comparatively small absolute efficiency in the engine itself. In a steam engine the theoretical efficiency is generally not more than .3; in a gas engine it may rise to .65. Then there are losses in steam pipes; losses in the cylinders of engines; in friction of the moving parts; in conversion of mechanical into electrical energy; in heating; in excitation of the dynamos; in mains; in batteries or transformers; finally, there is so considerable a loss in the incandescent lamp, for the sake of which all this waste is incurred, that no more than five per cent. of the energy which eventually reaches it greets our eyes in the form of light.

These losses are inevitable in the best regulated station, but they are each and all of them capable of being diminished by careful attention to detail or by rare mechanical skill; and just as the "negligible" losses in a system, if allowed to accumulate, may together dispose of 40 per cent. of the energy generated (as has been known in certain cases), so the resultant effect of a large number of petty economies may not impossibly be a very considerable saving.

In a lecture restricted to one hour, and

tempered to meet the exigencies of a popular audience, it could hardly be expected that many details would be given; and, in fact, Professor Kennedy, after dealing broadly with the losses due to what one may call "natural causes," and suggesting the lines along which development may be chiefly expected to proceed, did little more than hint at the actual economies which ought to be sought for in practice. But those behind the scenes know that at Westminster and elsewhere, under Professor Kennedy's *régime*, there is a watchful attention paid to minutiæ so systematic in its working and precise in its details that it would make the very hair stand on end of some of our more easy-going self-satisfied central station engineers.

For their benefit, and also because there are many besides who are neither self-satisfied nor easy-going to whom the methods in vogue at the Westminster stations would be suggestive and useful, we have persuaded Professor Kennedy to submit to the operation of being interviewed. For a man up to his eyes in work, who is advising half the towns in England on electric lighting at the same time, this last infliction of a *fin de siecle* age has many terrors, and the way that interview was procured is one of those things "into which," to quote once more from his lecture, "it would be a breach of confidence to initiate the ordinary reader."

Having caught one's hare, it is not always easy to cook him; but those who have had relations with Professor Kennedy will be prepared to agree that a couple of hours' conversation with him on his own subject is a pleasant and instructive experience. Some people like to affect a mysterious reticence about the secrets of their successful working. He does not.

In reply to a question concerning them, his answer was: "I think you are crediting me with more than I deserve. We have not effected any extra wonderful improvements at Westminster, but have simply done what any one else could have done. We take nothing for granted, make no allowances, and measure everything it is possible to measure. Consequently, we see at once where mistakes lie, and try to remedy them."

"What do you measure?"

"Well, coal, in the first place. Every ton of coal that comes into the yard is weighed twice. It is weighed on arrival and again before it goes to the fire. No extra labor or expense is involved, because the coal is simply wheeled over a weigher *en route* from the bunkers, and each barrow is tallied by the stoker. We have sometimes detected pretty large discrepancies in our coal bills in this way; as much as three tons in 70, for instance. The second weighing does not do much more than check the first, so far as this is concerned, but it serves a second purpose, which I will explain later.

"In the next place our coal is very carefully analyzed. We know exactly what we ought to get from it with the appliances placed at our disposal. I could tell you the calorific value of all the coal in our store, and how much water it ought to evaporate.

"Thirdly, the ash is all checked. We know how much coal is burnt, and we know how much ash is carted away. If the ash comes to unreasonably more than the 3½ per cent. or so of incombustible matter in the coal it is time to interview your stoker. That finishes the coal, I think."

"You were going to say something about the purpose of the second weighing."

"Oh, yes. That has sometimes further importance than merely to serve as a check on the first weights. It enables me to measure the 'stand-by' losses, viz., the amount of coal used in keeping fires up in the boilers when they are doing nothing. There is an impression abroad that the waste is very large. Dowson referred to it in his paper at the Civil Engineers, as a disadvantage of steam engine practice. One man I know puts the loss at 25 per cent.

"In order to see what it really was I have often had the coal separately noted which was fired to boilers which had their stop valves open, and to those whose stop valves were closed. I could thus determine, over a number of days together, how much coal was really consumed in making steam, and how much merely in being ready to make steam some other time. It was a shock to me to find that our 'stand-by' loss had been sometimes as high as 15 per cent., and I looked into the matter with some avidity."

"And have you succeeded in reducing it?"

"Very considerably. It was due to nothing but carelessness. Here are some of the many records which I have taken since. You will see that we have got it down to 7.2 per cent., only half as much as before. This is the lowest I have observed, but I daresay it has been lower, for the records are just taken at odd times."

"What follows coal?"

"Water. All the water we use is metered. And here I confess that I am at a loss. There is something wrong with our water consumption, and I do not quite know what it is. Look at these weekly returns. The amount of water returned as evaporated per pound of coal is absurd. It is in many cases much better than we can really be getting, and shows that we are losing water somewhere on its way to the boilers; possibly at the feed economizer relief valve. I am bound to say, however, that whenever we make strict tests, for eight or ten hours only, the consumption of water comes out about right; so that the fault is possibly in the return. Besides this, the water really turned into steam is much greater than that used by the engine normally. For this there are several possible causes, of course; leaky pump pistons, condensation in steam pipes, blowing off at the drain cocks, and occasionally at safety valves, etc. I believe the steam condensation is the principal trouble, and it is this that made me lay so much emphasis on superheating at the Royal Institution last week."

"Do you test for priming?"

"Yes, occasionally, but I have never detected any signs of it yet in our boilers."

"The next losses, I suppose, are those connected with the engines themselves?"

"We indicate the engines systematically every now and then; but it is a lengthy business, and so far we have always found that in this respect there was not much amiss."

"I hear that you are very strict in your tests of machinery before taking it over."

Professor Kennedy laughed, and said that he *had* been described as a thorn in the flesh by one maker. "But," he said, "it pays in the end. I will show you the curves I made of one combined set of engine and dynamo under strict conditions. You will see that we noted the water consumption at several different stages of the load. By plotting out the curve of water consumption during the trials I can tell forever afterwards at a glance whether my water consumption is tallying properly with the work we are getting from the engine."

The curves were shown in a book full of valuable records, all kept with extreme neatness by Professor Kennedy himself. It is impossible to speak too highly of the way in which every particular is recorded and tabulated from week to week in connection with the Westminster Company's working. Each weekly cost sheet is a miniature Board of Trade return, with additional entries of the weather, and such like, for purposes of future comparison and guidance. One especially interesting page resembled at first sight the photographs of Alpine scenery which Professor Kennedy collects as memorials of his summer climbing trips. This proved on inspection to be an estimated curve of output for a year, drawn in January, accompanied by the actual curve drawn from week to week. The peaks and dips in the lighting load represented such social events as general elections, Derby days, late Home Rule sittings, and the commencement of the grouse season.

After a too cursory inspection of these treasures we came back to the subject in hand.

"Our most precise and laborious measurements relate to the electrical losses. We take nothing off the log sheets except the voltage, which is recorded, generally, every 15 minutes. The dynamos have each an ampere-hour recording meter (Aron type) attached to them, and these meters are now checked several times a year by the potentiometer method.

"The question of what instruments to check by is a very important one. I cannot think it is wise to use ordinary switchboard instruments for the purpose. Our measurements are made with standard Clark cells and standard resistances sufficient to carry current up to 2,000 amperes. We use Mr. Crompton's potentiometer to a very large extent. It is a most beautiful instrument and very simple to use. I have a portable potentiometer which I carry about with me, and each of our stations has a complete potentiometer set with standard cells, which are exchanged every now and then for comparison.

"I make a point of now insisting upon accurate standards for instruments in my specifications. In this one (Aberdeen) you will see that I have specified clearly what these are to be. It is no use my passing instruments which possibly record British Association volts, when the act requires Board of Trade volts. I like to be on the safe side, and one cannot err by too great exactness.

"No, I don't think I am a faddist. There is a good deal of method in my —, call it what you please."

"Why do you not use wattmeters with your dynamos?"

"Because current is ultimately the thing paid for, and so we work to current. Our method of averaging the volts is, of course, not an exact one; but I am merciful enough not to expect my engineers to work out the exact average, which is rather complicated on a low tension system; we redetermine them periodically, several times a year.

"While we are speaking of the dynamos, look at these curves which I made during one of the tests of our plant before we took it over from the makers. Here is a dynamo which we ran at Willans' on an II engine, and the whole set did not give more than 79 per cent. efficiency (ratio of electric horse-power to indicated horse-power) at full load. This was below the guarantee, but I took it. On testing the same set after six or eight months' working I found that, through stiffness in the bearings having been worn off, and other matters of like nature, the set had an efficiency of fully 84.5 per cent. That, of course, is very creditable to the makers."

"Do you measure the losses in your batteries?"

"Certainly. I have at each station a couple of reversible Aron meters obtained from Mr. Miller, of the Kensington and Knightsbridge Company, one of which is placed on each of the outside mains of our three-wire system, next to the two halves of the battery, so that they register both charging and discharging current. They read ampere hours, of course. Here is a specimen of the battery readings of one of the station reports for last week:

	No. 1 Battery.	No. 2 Battery.	Total.
Charge.—Amp. hours...	4,160	3,870	8,030
" Mean volts.....	115	115	115
" Units.....	478	445	923
Discharge.—Amp. hours.	3,790	3,520	7,310
" Mean volts..	104	104	104
" Units.....	393	366	759
Efficiency.—Amp. hours.	91.3%	91 5	91.1%
" Units.....	82.1%	82.1%	82.1%

"The total number of units generated for the week at the station was 14,504. Of these the station consumed 205 for lighting, etc., and consumers got 12,909, so that the total on the circuits was 13,114. The proportion of this which passed through the batteries was 5.6 per cent.

"The coal consumption per unit *generated* in this week's cost sheet was 6.2 pounds, and per unit *sold*, 6.94 pounds. Of course, this is a good bit above our 'record,' for 'trade is very dull' in this bright weather.

"Taking our figures over the whole first quarter of this year (12 weeks only) we sold 522 260 units, and the coal consumption was 1,635 tons. This gives a proportion of 7.02 pounds of coal per unit sold. Last year for the same period we sold 335,000 units, and the coal consumed was 1,375 tons, making 9.2 pounds per unit sold. So you see we have improved—which is only to be expected; and the improvement was certainly needed."

"What are your 'unaccounted for losses' on the system?"

"About 3.2 per cent. last year. That includes all errors in measurement, all discrepancies between station meters and those of consumers, and, of course, any leakage; but this last matter is infinitesimally small. Of course, after subtracting the losses in the battery and the feeders, and the current used in the station, we ought to come out right. But that never happens exactly."

"Do you find that your electricity meters render a good account?"

"Very good, indeed. The Ferranti meters work excellently. The Aron meters are more troublesome, on account of the possibility of errors in their synchronism, but they start splendidly, and have very straight curves. I am now trying all the types of meter I can get hold of, but these two are the only ones I have largely used. We have a somewhat elaborate meter department in the Westminster Company, and take special pains with our meters, redetermining the constant of every single meter we buy before sending it out on circuit."

"Do you have many complaints to the County Council about your meters?"

"A few; hardly a dozen after the end of the Christmas quarter, I think. But, happily, the meter errors turned out to be very small in almost all cases, and in not a few they were against us. Speaking from memory, I think there have only been two or three within the last year which had an error as great as 5 per cent., and increased care seems to be always diminishing the error."

"Have you any further details to give about your system of measuring station losses?"

"You might mention that we now give the workmen themselves an interest in the economies they effect. Here, you see, I have on the cost sheet the weekly cost of fuel, stores, water and repairs. These (which really cover the station costs except salaries and wages) are all matters more or less directly affected by the carefulness, or otherwise, of our men. I took out the average cost per unit of these items at each station during the last half of 1892, made a reasonable reduction for improved working, and thus estimated what they might amount to for 1893. My directors then caused a printed notice to be drawn up and given to each man in their employment promising that 10 per cent. of all saving made on my estimate should be given to the workmen as a bonus, *pro rata*, on their wages. My estimate worked out at about 1.1*d.* per unit for the four items; and you will see from these sheets that the men have kept below it all the year as yet. I have great hopes that it will mean about a week's extra wages to each man. And I think they will deserve it."

"Do you find our *Lightning* tables useful to you in your calculations?"

"Most useful. I fancy I study the figures as closely as Chesterfield, Jr., can, and I find them even more interesting reading than the brilliant coruscations of 'Meteor' himself! Seriously I think that all central station engineers are greatly indebted to your paper for the admirable and impartial way in which you have carried out this work. I don't know whether all electrical men have found out how much food for reflection can be obtained by comparing your figures with those in Mr. Field's yearly analysis of the gas companies' accounts. You might make the suggestion for the benefit of those who have not yet dived into those figures."

TELEPHONE CHAT.

The Automatic Telephone Company will be granted a franchise in Oshkosh, Wis.

Saginaw, Mich., is to have another telephone exchange, the rates to be about half those now charged by the Bell company.

The Central New York Telephone Company has put in a new copper circuit between Utica and Richfield Springs, N. Y.

The International Bell Telephone Company, limited, has declared a dividend of five per cent. on the capital stock of the company, payable July 1.

The new telephone line between Jonesboro, Me., and Machias, now completed, is in excellent order and has much more business than was expected.

A telephone line is about to be built between Fremont and Norfolk, Neb., connecting the principal towns of the Elkhorn valley with the State exchange.

Wenatchee and Waterville, Wash., will soon be connected by telephonic communication, which will be of great advantage in dispatching business between the Big Bend and its nearest shipping point, Wenatchee.

The Bell Telephone output for the month ending June 20 was as follows:

	1893.	1892.	Changes.
Gross output.....	9,290	8,912	Inc. 378
Returned.....	9,812	4,414	Inc. 398
Net.....	4,478	4,498	Dec. 20
Since December 20:			
Gross.....	52,349	50,124	Inc. 2,225
Returned.....	27,934	23,610	Inc. 4.324
Net.....	24,415	26,514	Dec. 2,099

The West River Telephone Company has been organized at Brattleboro, Vt., with these officers: general manager, C. C. Fitts; local managers, T. P. Barber, W. F. Gleason, M. Underwood, H. N. Fitts; treasurer, J. C. Robinson. A line will be constructed from West Wardsboro through Jamaica to West Townshend.

The Sunset Telephone and Telegraph Company has voted to issue bonds to the amount of $750,000 to extend service throughout the State of California. One line through the San Joaquin valley has just been completed as far as Fresno and Tulare, while down the coast a line extends as far as Soledad. There is also a southern division running from San Luis Obispo to San Bernardino, taking in Los Angeles, San Diego and all the thriving southern towns.

The American Bell Telephone Company has begun its expected fight to protect its unexpired patents, and the issue was made at Chicago, on June 30, in suits in the United States Court against the recently established firms of William Hubbard & Company and the Cushman Telephone Company. In the bills of complaint the whole history of the Bell patents is given, with an exhaustive account of all the litigation which has been necessary to preserve the rights of the company intact and the various decisions which have been rendered.

General Electric Company's High Speed Electric Locomotive.

THE FIRST IN COMMERCIAL USE.

The first electric locomotive of any considerable size in the United States, and the first practically operative high speed electric locomotive in the world adapted to the steam railroad, has recently been completed at the Lynn works of the General Electric Company, and will shortly be exhibited at the World's Fair. Its completion marks a distinct advance in electrical development.

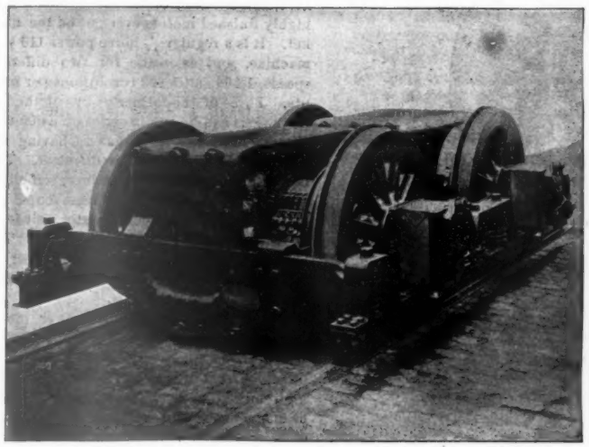


FIG. 1.—TRUCK OF GENERAL ELECTRIC COMPANY'S HIGH SPEED ELECTRIC LOCOMOTIVE.

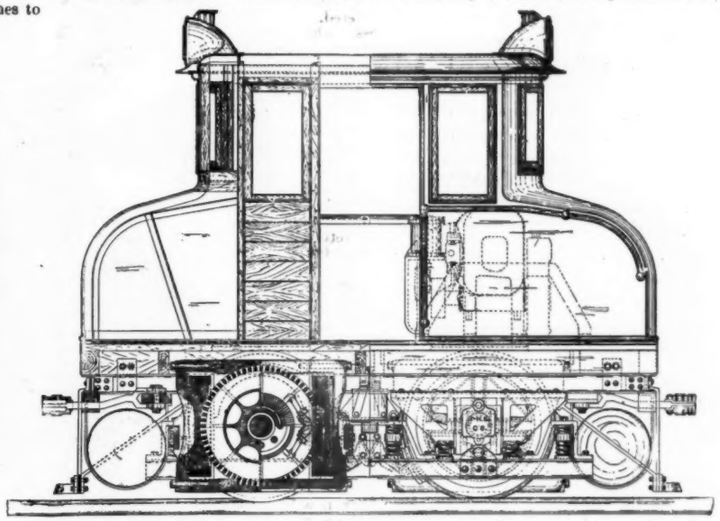


FIG. 2.—ELEVATION OF GENERAL ELECTRIC COMPANY'S HIGH SPEED ELECTRIC LOCOMOTIVE.

It is a 30-ton locomotive, designed for a normal speed of 30 miles an hour, primarily intended for operation on elevated railways, and for passenger and light freight traffic on less important steam roads. It is of compact construction, solidly and substantially built, and runs on four 44-inch wheels. Its dimensions are: 16 feet 6 inches long, 11 feet 6 inches high, 8 feet 4 inches broad, having its draw bars 2 feet 6 inches from top of rail—the Manhattan elevated railroad standard height. The draw bar pull is calculated at 12,000 pounds.

The motors are controlled by means of a series parallel controller set up in the interior of the cab. This device embodies all the latest improvements made in this type of apparatus by the General Electric Company. Under test it is found that the series parallel controller allows of a more gradual and easier starting of the electric motor, and the speed can be more delicately and instantaneously controlled than in the case of the steam locomotive.

The truck, suspended from the journal boxes, is constructed of heavy I beams, and castings, to which the hollow field spools are bolted. The armatures are of the iron-clad type, having each separate winding embedded in a mica lined slot cut into the curved surface of the laminated iron armature body. The axles of the locomotive pass through the hollow shafts on which the armatures are mounted. These shafts rest in bearings of the motor frame, and are connected to the axles by universal couplings, which allow of freedom of motion in all directions. The commutators are of massive construction, and there are four sets of brushes to each commutator.

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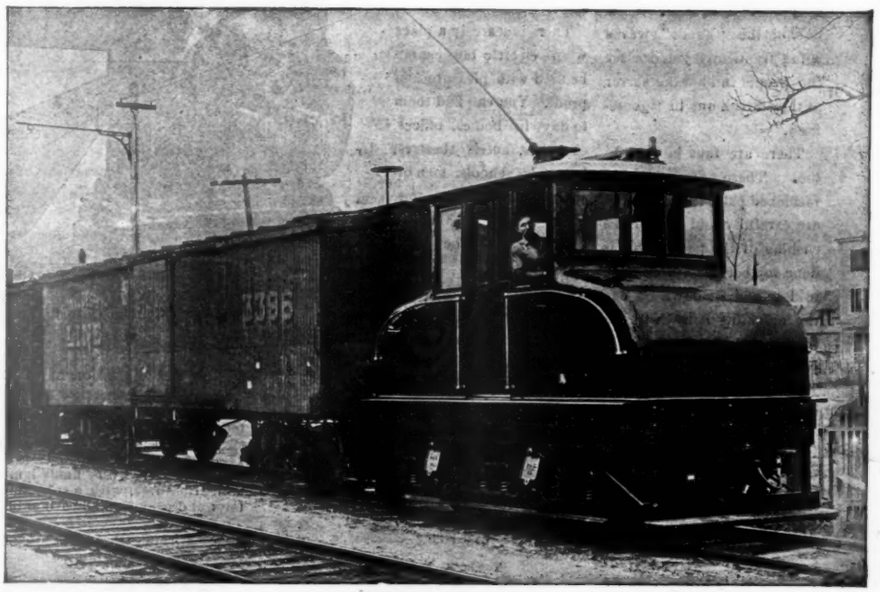


FIG. 3.—GENERAL ELECTRIC COMPANY'S HIGH SPEED ELECTRIC LOCOMOTIVE HAULING FREIGHT TRAIN.

The propelling power is furnished by two electric motors of especial design and construction, each axle being provided with one motor. The motors are gearless, and are supported on spiral springs resting on the side frames of the locomotive truck. This method of suspension leaves the wheels free to adjust themselves to the irregularities of the road bed, and consequently the wear to both tracks and motors is diminished.

The motor fields consist of massive iron forms the foundation for the locomotive cab, of sheet iron, of symmetrical design, and so curved off as to diminish the atmospheric resistance as far as possible. The interior is finished in hard wood. Two sliding doors are placed at each side of the cab, and the windows are so arranged as to permit of an unobstructed view in all directions. There is ample space in the cab for the motorman's movements, and it affords him considerably better protection than that usually vouchsafed the steam locomotive engineer. The position of the headlights is shown in Fig. 5.

The air for the brake is supplied by a special electrical air compressor, which also operates the whistles. This air pump has an oscillating cylinder of 6 inches diameter with a 6-inch stroke, supplying 6,000 cubic inches of air per minute at 70 pounds pressure. The motor is similar to the N. W. P. 2½ in general appearance, but is wound for a higher speed. The normal speed of the armature shaft is 675 revolutions, and of the crank shaft of the pump 110 revolutions. The dimensions of the air compresser are, length 41 inches, width 16½ inches, height 25 inches. The pump motor is controlled by a special rheostat. This, by an intermediary device, is automatically regulated by the air pressure.

This locomotive has been designed for a normal speed exceeding 30 miles per hour. The use of these locomotives over very long distances is at present limited only by the cost of long lines of electric feeders, and until the problem offered by this condition is solved, restriction of its employment must necessarily exist. But for places comparatively near each other and where traffic is dense—the denser the better—the electric locomotive is peculiarly adapted, for here all the advantages of electric propulsion are available, unhampered by the extreme expense involved in long feeder lines.

The evolution of the use of the electric locomotive will probably follow along the lines dictated by expediency and favoring conditions. At first they will probably be used in elevated railroad service, and in New York, Brooklyn and Chicago alone, their advent will be hailed with a feeling of deep gratitude. They will then probably be adopted as feeders to the trunk lines, both for freight and passenger traffic, and to operate short suburban lines, where a rapid, efficient service is requisite. Their peculiar fitness for switching purposes will advance their use another step, and then slowly as the different problems presented are overcome, they will invade the province of the trunk line steam locomotive, and the millenium of railroad travel will be within the realities of life.

Recent German Patents.

The following patents have recently been issued at the Imperial German Patent Office and furnished to the ELECTRICAL REVIEW by H. Zerener, Ph. D.

21 B 13787. Electrolytic preparation of finely divided lead for the filling of storage battery plates. Firma Berliner Accumulatoren-Werke. E. Correns & Company, Charlottenburg.

75 R 7940. Diaphragm for electrolytic cells. Adolf Riekmann, of Middlesex.

47 G 7573. Driving-gear of fly-wheel and friction wheels for the regulation of the supply of power by means of electromotors. Wilh. Grossmann, of Pforzheim.

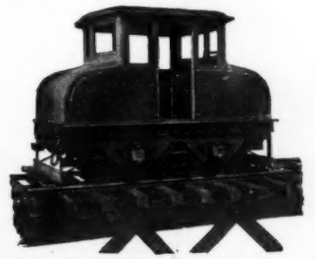


FIG. 4.—GENERAL ELECTRIC COMPANY'S HIGH SPEED ELECTRIC LOCOMOTIVE ON ELEVATED ROAD.

21 B 14160. Cut-out for arc lamps. Richard Bombe and Ferdinand Schuckhardt, of Berlin.

21 D 4664. Electric generator. A. Dielitzsch, of Dresden.

21 K 10087. Commutator brush composed of small metallic tubes. Karl Koch, of Elsey.

21 St. 3489. Automatic time cut-out for electric circuits. Stettiner Electricitats Werke, of Stettin.

21 P 6206. Attachment of solenoid cores to the carbon clamps in arc lamps. Hermann Pöge, Chemnitz, Saxony.

The work on the electric road through Gloucester City, N. J., and across the meadow land adjoining Timber creek is being rapidly pushed forward and the company only desire the proper franchises from the county and city authorities to enable them to complete the road.

THE ELECTRIC FAN MOTOR.

TYPES OF THE LATEST DEVELOPMENT OF THE MOST MODERN COOLING DEVICE.

A Boon to Offices, Hotels, Theatres, Churches and Residences.

ILLUSTRATIONS AND DESCRIPTIONS OF THE ELECTRIC FAN OF TO-DAY.

The word "fan" is derived from the root *va*, meaning "to blow." If the weather were cooler you might ask a philologist to explain to you how a word beginning with "f" is derived from a root beginning with "v." But he might charge you a V to tell you, and it's too hot to bother about it, anyway.

Fans, generally speaking, are of two varieties, the solid, flat kind, like a palm leaf, and those belonging to the folding family. Palm leaf fans and those made of little slivers of bamboo covered with rice paper and impossible Japanese pictures are the best, if you are running the fan business by man power, because they are the cheapest. Those of the folding variety are chiefly remarkable for the ease with which they break. If the fan happens to belong to a young lady it will surely break at the slightest touch. But your mother-in-law's fan never breaks—she can carry the same one for years. The more expensive a folding fan is, the easier it will break. A few shrewd men have realized this trait of the tribe and have set up fan repairing establishments, where it costs more to get a fan fixed than it does to buy a new one. Of course, you never find this out until you have had the repairs made and the man is standing there waiting for his money.

Some of these folding fans are very expensive. They are made of cobwebs or humming bird skins or high-priced air, and a great artist will spend months decorating them with all colors of paint arranged in the form of fat cupids, demure shepherdesses or Marie Antoinette ladies in white wigs. A certain ward in all large insane asylums is devoted to the use of weak-minded people who collect fans. They are weak-minded because they keep the fans in glass cases where they can't be of any service.

FIG. 2.—"FORM V2" HOLTZER-CABOT FAN MOTOR.

In Oriental countries the fans are made of peacock feathers or thin gold plates and such like. The gentleman who runs the harem has a lot of little colored boys with "next to nuffin" on to swish the flies off him and make a breeze by waving these fans about.

On the stage you will always find fans. The Spanish beauty generally carries a red one—that is red on one side and black on the other. She waves it to and fro all the time, especially when she is speaking her lines and when the rhythm of her words and the motion of the fan become synchronous the effect is very intoxicating on the hero of the play, who loves her madly. The audience smiles and wants some one to cure her "glass arm." In a Christmas tableau or any play with an Oriental scene which is put on the boards in cold weather you will see the big peacock feather fans. The coryphees and haremites are generally clothed pretty lightly, and the draughty stage is cold enough as it is. When one of the "supes" waves a fan frantically you can see the people in its wake shiver as they break out in "goose-flesh."

There are fans in church, too. These are the old fashioned palm leaf kind and are carefully laid flat on the cushion of the pew. This is done so that when you come in late and sit down on one the crackling noise will attract everybody's attention to you.

Naturally you have fans at home. Everybody has. But you have a special one for yourself that you keep in a special place. This is the one that all the rest of the family use and the one that you can never find.

The modern fan, the truly refined, the *ne plus ultra* of the whole fan family is the electric fan. Broadly, this device consists of an electric motor, and to one end—and sometimes to both ends—of the armature shaft is attached a set of metal wings resembling the propellor of a boat. And, indeed, the electric fan operates much the same way as a propellor, only different. The propellor doesn't squirt water while the boat stands still; it pushes the water out behind and moves the boat forward. The electric fan doesn't move the motor around because it's too heavy. The fan blades simply grab the air and shove it out in a constant, cooling stream which has often been known to save the life of the father of a large family.

Many people think that because they haven't an electric light circuit handy they can't indulge in electric fans. The wise electrician has foreseen this difficulty and provided fan motors run by either storage or primary batteries. The writer used a battery fan motor in his bed room last summer and cooled his slumbers during all the hot nights. He regrets to say that his right foot got uncovered one night and he has suffered with a chil-blain ever since.

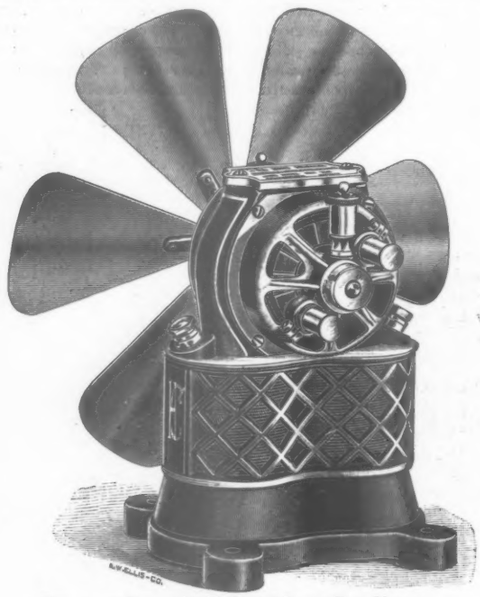


FIG. 1.—"FORM F" HOLTZER-CABOT FAN MOTOR

There is scarcely a place where electric fans cannot be used with pleasure and profit. You can find them to day in homes, offices, churches, hotels, theatres, hospitals, schools, men of-war and boiler-rooms. They don't need them in Heaven, and the Devil hates them.

If the *Atlanta Constitution* would provide its poets with electric fans, the public would not be encouraged to believe that it is

TOO HOT.

Too hot to be merry,
Too hot to be sad,
Too hot to be very
Amusing or mad;
Too hot to be fleeting
O'er mountain and main,
Too hot to be eating,
Or drinking—champagne.

Too hot to be wishing
For winters gone by;
Too hot to go fishing—
To stand or to lie;
Too hot to know whether
You'll melt, and will make
A streak in the weather—
A chop or a steak.

Too hot for the screeching
Of trains through the State;
Too hot for long preaching
And passing the plate.
Too hot for your laughter—
To live or to die
And a blazing hereafter
To finish the fry!

Following this are described several kinds of electric fans. There are others, of course, and these we may mention later.

The Holtzer-Cabot Fan Motors.

We illustrate herewith several of the most popular of the many styles of fan motors manufactured by the Holtzer-Cabot Electric Company, of Boston, Mass., which, from the excellence of their construction have met with such universal approval among the trade. The company have been running their factory at Brookline, one of the suburbs of Boston, to its full capacity during the entire season. At the present time they have 190 men constantly engaged in turning out motors, and are still considerably behind their orders.

"Form F" is their new production for 1893, and is one of the most ornamental and highly finished motors ever put on the market. It is a regular $\frac{1}{10}$ horse-power 110 volt machine, and is made for two different speeds, 1,100 and 1,600 revolutions per minute. Three of the former or five of the latter speeds can be run in series on a 500 volt circuit. The fan is of brass, having six blades, and is 12 inches in diameter. The bearings are of phosphor-bronze, self-aligning, and are lubricated by grease cups. It is fitted with radial commutator, self-feeding carbon brushes and ring armature. The bright parts are nickeled and the rest japanned and lined in silver; the weight complete with fan is 18 pounds.

Form "V 2" is a $\frac{1}{4}$ horse-power motor built expresely to run on a 500 volt circuit, which in so many places affords the only direct current available. It has specially high insulation between the various layers of magnet coils and between the armature coils, commutator segments, core and frame. The commutator is of large diameter, and is made up of 36 segments. The armature is beautifully built, and can be run safely with the fan off at 6,000 revolutions per minute. The fan is of aluminum, 15 inches in diameter, and the motor weighs complete 39 pounds.

Form "A. C. I." is a $\frac{1}{8}$ horse-power alternating current motor, and at its normal speed of 1,400 revolutions consumes about $1\frac{1}{2}$ amperes at 52 volts. It is a multipolar machine, having very finely laminated fields and armatures, with a substantial commutator and pencil radial carbon brushes.

FIG. 3.—"FORM A. C. I." HOLTZER-CABOT FAN MOTOR.

The Mason Portable Electric Fan Outfit.

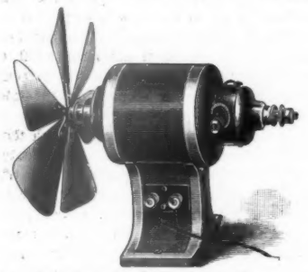
The Mason Electric Company, 10 and 12 Vandewater street, New York city, manufacture the battery fan outfit illustrated elsewhere. Current is supplied from one or more of Mason's primary batteries, which are enclosed in a handsome cabinet. The set as shown will, it is claimed, run for 30 hours at a cost of eight cents.

Where an electric light or power circuit is not available, these primary battery motors will be found to satisfactorily answer such requirements as the ventilation of sick rooms and offices. The price of the outfit is moderate and the batteries can be renewed at small expense.

The Storey Desk Fan Motor.

The Storey desk fan motor, for which the Dahl Electric Company, 120 Liberty street, New York, are general Eastern agents, is shown in the illustration herewith. This motor is the invention of Mr. I. E. Storey, whose "solenoid" motor for direct driving has already been illustrated and described in the ELECTRICAL REVIEW.

The construction of the field magnets of of this machine presents a unique feature. There are four poles so arranged that while the center of the machine is of one polarity the ends are of opposite polarity, both ends being of the same polarity. There are eight



THE STOREY DESK FAN MOTOR.

distinct magnetic circuits, making the path of the magnetic lines unusually short and of very low resistance, giving maximum efficiency for minimum quantity of wire.

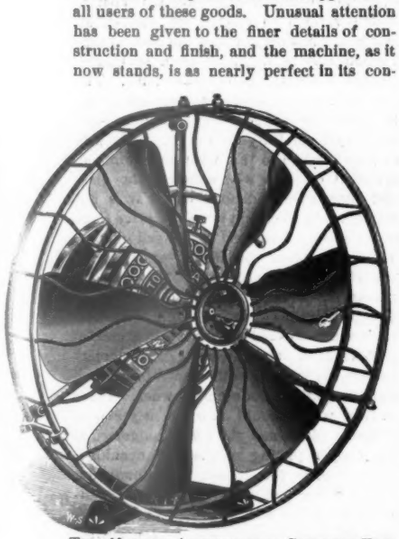
The armature is of the drum type, toothed. The bearings are of peculiar construction and of such a design that the motor can be placed in any position as long as the center line of the shaft is horizontal. The boxes are moisture and dust proof.

The motor is practically a hermetically sealed machine and being entirely closed no outside injury can possibly arise from any internal condition incident to the operation of the motor, such as the burning out of armature or fields or sparking at the brushes. This motor is manufactured by the Hornell Iron Works, of Hornellsville, N. Y.

The Dahl Electric Company are also agents for the popular Meston alternating current fan motor which is illustrated and described below.

The Meston Alternating Current Fan Motor.

The Meston alternating current fan motor has long been favorably known wherever fan motors are in use, and the "1893 model" contains a number of new features which will undoubtedly meet with the approval of all users of these goods. Unusual attention has been given to the finer details of construction and finish, and the machine, as it now stands, is as nearly perfect in its construction and operation as it is possible to get it. The motor is completely enclosed, none of the working parts being visible or exposed to possible injury; at the same time it is easily accessible, as the end covers may be removed and the armature taken out without disconnecting or disarranging the adjustment.



THE MESTON ALTERNATING CURRENT FAN MOTOR.

The armature is of special laminated iron, and as there is no wire used, it is impossible for it to burn out or ground.

The commutator is of the finest quality of tempered copper, coined by heavy pressure, insulated and compressed into a heavy metal shell, insuring absolute stability and smoothness as well as unexcelled wearing qualities.

The brushes are guaranteed to last an entire season, and the brush holder, which is built as part of the armature, has no adjustments which can be disarranged.

The bearings are self-oiling and need no attention whatever. Another feature is a regulating and reversing device, by which the speed of the motor and quantity of current are readily controlled, and by means of which the motor can be reversed if desired.

The general appearance is neat and compact, and at the same time very ornamental.

The Brown Electric Company, of Boston, Mass., control the exclusive sale of the Meston motors in the East, and report an unusually heavy demand for them so far this season.

Wing's Disk Fan and Electric Motor Combination.

The illustration accompanying this article shows an electric ventilating fan manufactured by L. J. Wing & Company, 126 Liberty street, New York. The motor is built as a part of the fan, requires a minimum power for driving, does not obstruct the light, is practically noiseless and forms a splendid application of power for heating, ventilating or cooling.

L. J. WING & COMPANY'S DISK FAN AND ELECTRIC MOTOR COMBINATION.

The blades of the fan are curved and have an expanding pitch, thereby increasing the amount of air moved and reducing the slippage. The operation of the fan is entirely safe as its whole mechanism is placed inside a framework, and the arms are made of the best wrought iron. The blades are adjustable and may be set to suit the conditions under which the fan is to operate. A current of air can thus be increased, reduced or turned at will. Owing to its form and light weight Wing's ventilator can be put at either end or the center of a pipe, in a wall, window or door, and can be run horizontally or perpendicularly.

The wide range of application to which these fans are adapted shows that there are very few mills or factories where they cannot be used to advantage or profit. When installed in rooms for drying such goods as wool, silk, leather, paper hangings, etc., they are especially valuable, as the product comes out softer and in finer condition than is usual. For removing steam, vapors, smoke, heat, gases, dust and acids from rooms or buildings they do wonderful work and soon pay for themselves. They have been very successfully adapted to the ventilation of mines and tunnels.

The New W. S. Hill Rotating Fan Motor.

The illustration herewith is an excellent representation of the new rotating fan motor which has just been put on the market by the W. S. Hill Electric Company, of Boston, Mass. As will be seen at a glance the motor is of an entirely new design, and the rotation is obtained in a remarkably simple way from the current of air generated by the fan itself. The crescent-shaped rudder against which the air is driven can be set at any angle, and the speed of the revolutions governed thereby, or by being set so as to offer no resistance the motor can be made to remain stationary.

The simplicity of construction is another strong point in its favor, as there is absolutely nothing to get out of order, and the motor can be run continuously for an entire season without requiring any attention whatever.

The field magnets are made in one piece of wrought iron casting, and the wire for the field circuit is wound directly on to the iron magnet core.

The armature is journaled in a top plate of non-magnetic metal and runs in graphite journals that require no oiling.

This top plate is of one piece and the armature is mounted and nicely balanced, and as all the parts are made interchangeable, any armature will fit any field magnet.

Round carbon pencils are used for brushes, and are held against the commutator by small spiral springs, the tension of which can be graduated by a thumb screw.

The stationary motors are mounted on two separate feet of cast iron that are secured to each leg of the magnet.

The rotating fan is mounted on a non-magnetic metal turn-table, that is pivoted within an iron base, that contains a pair of insulated ring contacts to deliver the current to the motor while it rotates. An arm projects from the turn-table, at the outer end of which the crescent-shaped rudder is secured with a thumb nut that permits of its being set at any angle desired to control the speed rotation.

It is perfectly noiseless, self-lubricating, and weighs complete about 20 pounds. The fan is 12 inches in diameter and runs at 1,500 revolutions per minute on a 110 volt circuit, requiring less than one ampere of current to operate it.

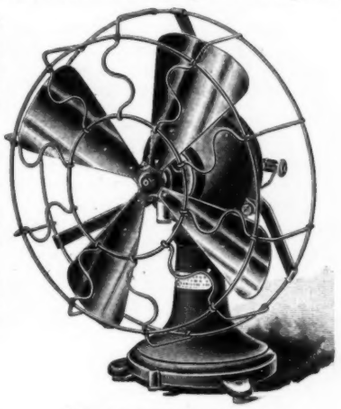
THE W. S. HILL ROTATING FAN MOTOR.

The advantages of rotating motors have been thoroughly demonstrated, and experience has led to a combination of all the best features in this latest production, with the additional advantage of being able to run the same machine either as a rotating or stationary motor at will.

The well known reputation of the W. S. Hill Company is sufficient guarantee for the excellence of the workmanship, and the motor has given splendid results wherever so far introduced.

The Lundell Fan Motor.

The Interior Conduit and Insulation Company, of 44 Broad street, New York, of which Mr. Edward H. Johnson is president, are now manufacturing and selling the



THE LUNDELL FAN MOTOR.

justly celebrated Lundell fan motors. This motor is built on such lines as to be of the utmost convenience even under the most unfavorable conditions. The compactness with which it is constructed makes it especially adapted for office and desk use, and anyone who has any doubt of its remarkable efficiency as a producer of "that pleasant summer breeze" need but to occupy a seat in one of the theatres, usually so hot and disagreeable in the summer term, which is equipped with the Lundell fan motor, and he will have his doubts melted away into thin air.

The accompanying illustration shows the style known as No. 660, and is adapted for general uses. It has a regulating switch giving three speeds, viz., 1,600, 1,200, 800 per minute, for primary or storage battery circuits of eight volts and five amperes capacity. This motor takes a 12-inch fan, and has a capacity of one-twelfth horsepower. A similarly constructed one for constant potential incandescent circuits is suited for use in those buildings supplied with such current. The japanning of the fan blades of this motor has produced a remarkable effect, viz., that of rendering the revolving blades invisible and allowing of a non-interference of light and a consequent uninterrupted vision of those objects which may happen to be on the side of the fan away from the observer. The heavy black japanned guard prevents the liability of accident. The whole motor being enclosed in a sheath of iron, the only movable part which is visible is the fan itself. By this means it will be seen that all contact with dust and other foreign materials is entirely avoided.

(Fan motors continued on pages 268 and 269.)

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The financial stringency is easing up a little. Money on call loans has dropped down from the exorbitant rates asked within the last two weeks and confidence is being gradually restored. The calling of a special session of Congress, on August 7, has had a beneficial effect, as it is taken to mean that the Sherman bill will be repealed. Trading on the stock exchanges is mostly confined to "professionals." We may confidently look for brighter and better times. One of the best results of these hard times will be the weeding out of mushroom concerns.

A cable car ran amuck on Broadway one day last week because the cable got twisted in the grip so that it could not be released. The car continued on its way until a policeman telephoned to the power station and the engines were shut down. Numerous trucks were wrecked and many horses injured. Luckily no people were hurt. This accident may happen again. If we must tolerate cable cars on Broadway, let us insist that every safeguard be used. An electrical signalling system, with stations every half block, should be installed at once, so that the cable may be instantly stopped in case of accident.

TRUE HEROISM.

It is not very often that we hear of an engineer who sticks to his throttle until the crash comes. When he does, however, his name generally goes down to posterity, perhaps in poem or song.

Unfortunately, he seldom lives to enjoy his oft sounded praises; his is but a poor satisfaction. Now a Brooklyn motorneer comes to the front. Long may his name be surrounded by sadly won emblems of remembrance.

His brakes refused to work and his car rushed madly down grade towards another which stood quietly, little expecting the shock so soon to come. With set teeth and swelling veins and muscles he vainly struggled to apply his brake. It was of no avail. A jump from the side of the car meant a few harmless bruises; to remain at his post, meant, perhaps, death. Unflinchingly he stayed until the last moment, then came a grinding smash and all was over. His career of usefulness is at an end, but the story of his bravery should live with the histories of our noblest heroes.

THE ELECTRIC FANS.

"What a world of comfort electric fans foretell." Non-owners of electric fans, can you imagine what this little device can do for you, what a privilege it is to sit during the hottest kind of a "sizzard" with the windows closed down tight to shut out the heat, in the delightful breeze caused by an electric fan? Think of the delicious enjoyment, almost touched, we might think, with a little feeling of superiority over the sweltering multitude as they pant on in their respective paths of duty. You smile audibly to yourself as you watch some particularly perspiring individual, generally of the kind who might say with Hamlet, "Oh, would that this too solid flesh would melt!" He madly rushes to catch a street car when another follows at the distance of a few feet.

Then you moralize a little and begin to believe that you are really better off than somebody else. Dog days do make people so pessimistic. Every one knows you can't help it. General Humidity is blamed; and rightly, too. But you, dear reader, if you are the fortunate possessor of an electric fan may rise above the surging multitude and look down upon them in your superior wisdom; for you become wiser when you own one. This has become an established fact. Charles Lamb in all his glory could not do justice to the electric fan.

Think what an alleviator of suffering it may be. Oh yes, it has its pathetic side also. Let us go back, for a little while, to a period 30 years ago. There were no electric fans in those days. Let us select a particular incident, a most pathetic one.

On the top floor of a house, not too well supplied with the luxuries of life, tossing on a bed of pain, lies a little sufferer. Beads of perspiration are seen upon her forehead. It is the middle of summer. The heat is intense. Patiently at the side of the bed sits the mother, and not for an instant does she relax the regular motion of her arm as she fans the child. Now she changes the palmetto leaf to the other hand; the labored breathings of the one in pain are heard, and the waving and rustling of the fan is the only sound which seems to penetrate the thick, heat-laden air. The observer wonders when she will tire. Never, unless exhaustion overtakes her, for she is a mother, and it is her offspring for whom she is laboring. It is, indeed, labor of the most tiring kind.

What a difference there would be were the fan motor to take her place. Think of the grateful breeze cooling the fevered brow, of its merry hum. One can almost imagine oneself at the most fashionable summer resort with a ten-dollar-a-day sea breeze whistling merrily through his waving locks. Oh! it it glorious. Buy a fan. Shut your eyes and see for yourself.

A HIGH SPEED ELECTRIC LOCOMOTIVE.

We illustrate in another place in this issue what is believed to be the first high speed electric locomotive for commercial use. It is the product of the General Electric Company, and reflects great credit on its designers and builders. This locomotive is designed to run at 30 miles an hour, and exerts a draw-bar pull of 12,000 pounds.

The field of usefulness open to such a motor is very broad. As an accessory to steam trunk lines on feeder roads it will certainly prove its value. For suburban electric roads, switching purposes and for hauling material in large plants nothing could be better. Its possibilities for use on long roads are only limited by the cost of line construction.

This locomotive will form a part of the World's Fair exhibit of the General Electric Company, and will undoubtedly be closely inspected by American and foreign engineers.

We suggest to the New York Gas Commission that Seventh avenue, from Central Park to at least 135th street, would be much improved by the addition of a sufficient number of arc lights.

LETTERS FROM A LABORATORY.—LIII.

BY JULIAN A. MOSES.

The uses of wire gauze in the laboratory are numerous. It affords an excellent means of distributing the heat from Bunsen burners almost as equably as does an iron or brass plate, and owing to the fact of the presence of the many small openings, much more heat is thus enabled to pass to the object requiring an increase in temperature. It is, therefore, more economical, although many of the experimenters of the older school disparage its use, preferring absolute safety to the vessels employed to rapidity of manipulation. Not alone is it of service in the chemical laboratory, but to the electrician many occasions will present themselves where the employment of this material instead of sheet copper or brass may be more advantageous in point of facility of manipulation.

Anyone who has had experience with the thin glass globes used for covering delicate objects and instruments will be aware of the many accidents that are liable to befall them in the workshop. By covering them, however, with wire gauze, they may be in a measure prevented. Skylights thus protected have had freedom from injury. Its usefulness has been proven.

In order to cover the glass globes with gauze which has been purchased in sheet form it is necessary to make a soldered joint upon the glass. This is extremely difficult to do without cracking the globe, in fact almost impossible when a good piece of work is desired. As regards covering the spherical part of the globe or shade, with the sheet gauze, this is indeed a tiresome operation. In order, however, to avoid these difficulties another means may be resorted to, viz., the electroplating of the gauze directly upon the glass.

This is a process which may have many more applications. Much ornamental gauze work is now being made by a large firm of electroplaters in the following manner: Instead of wire gauze being used directly, ordinary mosquito netting or fine lace is employed as the base, afterwards electroplated, upon which may be drawn or cut out whatever figures or designs which may be desired. Handsome window screens may be thus made, the large variety of intricate lace patterns allowing of a varied and choice selection.

To prepare a covering for the glass globes it is but necessary to fit a lace or netting bag over the outside and remove it to coat it with a varnish to receive the conducting material. Almost any medium slow drying varnish may be used, or plain shellac in alcohol, if nothing better is available. The lace cap must, as soon as the varnish is perfectly dry, be slipped over the glass globe, and fitted carefully around it. This precaution is taken so that when the plumbago is dusted on none will adhere to the glass and thus give a deposit where it is not wanted. As soon as it is well in place some of the solvent used must be sprayed upon it. This will soften the shellac or whatever material is employed, upon the threads, preventing it from spreading to the glass. The graphite may now be safely dusted on from a fine-meshed stocking, being careful afterwards to obtain a close grained contact surface by rubbing with a soft brush well immersed in the conducting powder. Three or four wires should now be attached at different places and the whole immersed in the copper plating solution. A cyanide is preferable, as the deposit thus obtained is even and fine grained. The slower the deposit the better will it prove as a resisting material, and the finer will be the surface resulting.

To finish the outside of the meshes and give it a neat appearance, it is advisable to dip it in or brush it with a dilute solution of nitric acid, afterwards exposing it to the fumes of ammonium sulphide to give it a dense black coating. It is best to lacquer the gauze, which will now be found to present a resisting surface to many of the strains and jars that the globe or shade is liable to have whilst in the laboratory.

CORRESPONDENCE.

OUR CANADIAN LETTER.

Dundas, Ont.—The council is considering the question of lighting the streets by electricity, and tenders are now being received.

London, Ont.—Geo. Craddock, architect, invites tenders until the 28th inst. for furnishing the necessary gearing and electric motor for hoist for Mr. Robert Green's warehouse, Carling street.

I Am informed that the plan of operating lock gates by means of steel beams driven by electrical power was proposed by Mr. Munro, C. E., for adoption in the structures of the Soulanges Canal. The experiments are to be made at Melocheville, Que., as there is water power at that place to drive the dynamos required in carrying on the tests. Should this scheme, as is probable, prove successful, it will doubtless be applied to the gates of the enlarged canals now in course of construction.

Fredericton, N. B.—Mr. Chas. W. Beckwith, city clerk, is receiving tenders addressed "City Clerk, Fredericton, N. B.," for lighting the streets of said city by electricity (arc lights). Fifty arc lights will be required to be run per "moonlight schedule." A contract will be entered into to run for 10 years. The contractor will be required to furnish, put in and run dynamos, machinery, plant and materials at his own charges in all things. Further information will be furnished on application to city clerk.

Montreal, July 6. J. A. C.

Proceedings Against Incandescent Lamp Users.

We have received the following information from the General Electric Company:

Judge Lacombe of the United States Circuit Court, on the first of July, granted injunctions to the Edison Electric Illuminating Company, of New York, against the Holland House and the Hotel Imperial, prohibiting them from using incandescent lamps infringing the Edison patent, under which the Edison Electric Illuminating Company is sole licensee in the city of New York. The injunction is suspended in its operation for 10 days to enable the hotels in question to obtain other means of illumination.

These cases were the first that have been brought against *users* of the Edison lamp patent as distinguished from *manufacturers*, and the decision is far reaching in its effects. It is of great importance especially in view of the recent refusal of an injunction by Judge Hallett in St. Louis, against a Western manufacturer. The decision will be regarded as a rule for all users of other than Edison lamps in the States constituting the second circuit, and other suits will be immediately brought against other users similarly situated. The decision will doubtless secure to the Edison Electric Illuminating Company the incandescent lighting business in New York city, and go a long way toward securing to similar licensees the same privilege in other cities.

Advisory Council, Chicago World's Congress of Electricians.

TO THE EDITOR OF ELECTRICAL REVIEW:

Dr. Gray has just received a letter from Dr. von Helmholtz announcing that he will take part in the conferences of the International Electrical Congress, in Chicago, as the official delegate appointed by the German Government. He will be accompanied by Drs. Feussner, Kurlbaum, Leman, Lindeck, Luncineer, and Pringsheim, of the Riechsaustalt. Dr. Lindeck will read a paper on "Materials for Standards of Electrical Resistance and their Construction." Professor E. Hospitalier will be in New York, about July 9, and will read a paper before the Congress, the topic not yet announced.

Yours truly,

H. S. CARHART, *Secretary*.

Ann Arbor, Michigan, July 8.

He Was Answered.

"Why is the beautiful sun on the mountain top like the ELECTRICAL REVIEW?" inquired the country visiting editor, expecting, of course, the only answer would be: "Because it is red."

"Papa, is it because it hurts our eyes to look at it?" asked the editor's nine-year-old daughter.

Papa's answer was not heard amid the roars from the listeners.

A foreign newspaper printed in English refers to Mr. Nikola Tesla as "Tessler." Such is fame!

The "Electrical Review" Register at the World's Fair.

The following visitors registered their names at the ELECTRICAL REVIEW headquarters in the Electricity Building at the World's Fair during the period ending July 8, 1893:

Chas. Ackerman, Athens, Georgia.
G. Max Adam, Weinnigen, Germany.
H. C. Adams, Jr., New York, Fort Wayne, Electric Co.
P. R. Alsdorf, Utica, N. Y.
R. R. Alwood, M. D., Montpelier, O.
A. E. Anderson, Minton Place, O.
T. Anizan, Paris.
V. E. Armstrong, Bryan, Tex.
H. Armstrong, Pekin, China.
L. C. Bailey, Hailey, Idaho.
Milton Barlow, Chicago, Ill.
W. H. Benham, Cedar Rapids, Neb.
Chas. D. Blaney, San Jose, Cal.
J. Blumenstel, New York.
J. O. Boettcher, Weimar, Texas.
M. J. Branden, New York.
Geo. W. Broome, Knoxville, Tenn.
E. J. Buck, New York.
H. C. Bullard, Sedalia, Mo.
Edwin C. Caldwell, Chicago.
Geo. Carey, Salem, Ohio.
Camito Castillo, Guatemala, Central America.
J. C. Chamberlain, New York.
W. P. Cooke, Port Arthur, Canada.
Eugene J. Courtenay, Boston, Mass.
Wm. Craven, Belvidere, Ill.
Harry Duane, New York.
Wm. Eamshau, Philadelphia, Pa.
A. P. Eckert, New York, "Day's Kerite."
A. H. Englund, Chicago, Ill.
C. B. Estay, Cleveland, O.
E. L. Ford, Allegheny, Pa.
H. J. Glover, Brooklyn, N. Y.
W. R. Graham, Sidney, O.
H. L. Grant, Peoria, Ill.
Thos. G. Grier, Chicago, Bryant Electric Co.
James I. Gulick, New York.
H. M. Halleman, Apex, N. C., electrician.
Wm. J. Hammer, New York.
C. Hartwell, Jr., Mobile, Ala.
Geo. W. Head, New York.
H. C. Heinz, Pittsburgh, Pa.
E. A. Hines, Mobile, Ala.
Wm. A. Hovey, Boston, Mass., American Bell Telephone Co.
W. S. Hugh, London, England.
T. M. Hyndman, Pittsburgh, Pa.
Perry Jacobs, London, England.
H. Jenkins, Kingston, Pa.
Ed. C. Jerman, Indianapolis, Ind.
W. E. Keily, Chicago, *Western Electrician*.
Rankin Kennedy, London, England.
Herman Kregelues, Cleveland, Ohio.
E. M. Kunkel, Davenport, Iowa.
Paul Victor Lath, Cincinnati, O.
Oscar Lee, Seattle, Wash.
Julius Lefmann, St. Louis, Mo.
J. G. Lorrain, London, Eng., M. I. E. E.
E. H. Lyon, New York, Chicago Telephone Co.
Robt. A. Magee, St. Mathias, Minn.
C. J. Manhouse, Kalamazoo, Mich.
Frank C. Mason, Brooklyn, N. Y., Superintendent Police Tel.
W. R. Mason, Chicago, Railway Equipment Co.
D. A. McDonald, New Orleans, La.
F. A. McElwain, Brookfield, Mo.
A. Newman, Chicago.
T. C. Packman, Sisson, Cal.
L. Page, Lawrence, Kans.
Ralph W. Pope, New York, secretary A. I. E. E.
A. M. Parker, Boston, Mass.
A. H. Patterson, New York.
C. T. Reeve, West Superior, Wis.
E. C. Rhodes, Sisson, Cal.
C. J. Richards, New York.
G. A. Richmond, Stillwater, Minn.
W. N. Ryerson, Montclair, N. J., Columbia College.
Albert Scheible, Chicago, Ill., with Geo. Cutter.
Chas. Seilen, Alma, Wis.
Leon F. Seveny, Boston, Mass.
E. N. Shumway, Groton, Mass.
John Franklin Simons, 1069 Bushwick avenue, Brooklyn, N. Y.
Harry I. Skilton, New York, Ball Electric Light Co.
C. L. Snowden, Chicago, *Street Railway Review*.
S. B. Soloman, Rochester, N. Y.
C. E. Stump, New York, *Street Railway Journal*.
M. J. Sullivan, New York.
Chas. C. Sullivan, Elmira, N. Y.
J. A. Swanson, Wall Lake, Iowa.
Thos. R. Taltavall, New York, *Electrical Age*.
F. W. Terpening, St. Louis, Mo.
A. L. Thompkins, Nyack, N. Y.
Wm. Thompson, Glasgow, Scotland.
F. B. Whitmore, West Union, Ia.
Fred. B. Winter, Portsmouth, Ohio.
Au. Yah. Wadey, Helsingfors, Finland.
B. M. Young, Morgan City, La.

Wall Street and the Electrical Stock Market.

The financial situation at the present time is reflected by the bank statement issued to-day. It is regarded as the worst in eight years. The loans aggregate $418,685,900, and the net deposits $398,679,900. These two items, as compared with the previous week, show an increase in loans of $5,035,500, against an increase in deposits of $700,200. It is very rarely the loan item is as large as that of the net deposits. The statement shows an excess of $30,006,600. Last year this time loans were $33,989,900 less than net deposits. This abnormal condition of affairs has week by week become more aggravated, the weekly increases in loans being largely in excess of those of deposits. Had the statement appeared earlier in the day, its effect on the market would have been very serious.

The action of the banks a week ago last Thursday in loaning $6,000,000, undoubtedly averted a very serious panic. They were enabled to take this action through the issuance of Clearing House certificates. Up to this date there has been issued $22,515,000. The call money market has possessed an easier tone, owing to rather free offerings. Time money, however, is hard to get and is at a premium. Exchange through the week has been weak, and closed at the lowest prices under a heavy pressure of commercial bills.

The state of trade throughout the country, while reflecting adversely the financial conditions, show an improvement. July settlements imparted a perceptibly better tone to business circles. There was some recovery in prices from the lowest. An increase in confidence on the part of New York bankers and brokers resulted in an easier money market, with a better movement in commercial paper. The weak spot is Boston, whose commercial paper is practically unsalable. Distributions of goods to consumers have been better and fewer orders have been countermanded. There is a little apprehension of stringency as a consequence of the approaching stock movement. Chicago banks are feeling the effects of the tying up of funds in wheat. Nearly all the produce markets are higher as a consequence of easier money. Copper, tin and hogs are lower, and pig iron demoralized. Wool is the most depressed staple. The boot and shoe trade is slow with few buyers. The prospects of dry goods trade are favorable. Failures for the week, 224. Bank clearances at 55 cities for the month are 8 per cent. less than last year, and are lower than in any year since 1888, except 1891.

The stock and bond market has been extremely quiet, dull and professional. The only *bona fide* transaction consisted of further liquidation by weak holders whom the tight money forced to close out. This stock falling upon the stagnated market invariably resulted in lower quotations. High money rates effectually prevented buying of any consequence. Commission houses, almost without exception, advised their customers to keep out of the market.

During the week, money worked a little easier owing to the payment of July interest and dividends, and towards the close possessed a somewhat better tone. Exchange instead of advancing on easier money declined on rather free offerings of commercial bills, including rather large amounts of grain bills. This movement taken in connection with lower money rates is construed to mean that we are approaching a normal basis and that gold imports are a thing of the near future.

The effect of President Cleveland's announcement of a session of Congress in August on the market was insignificant. A slight rally took place, which was almost immediately checked by further liquidation. This shows conclusively that until liquidation runs its course and accounts are adjusted on a lower basis, no decided improvement can be hoped for.

General Electric showed some strength on sporadic covering, ranging throughout the week between 69½ to 72. Its close was rather strong and the general opinion prevailed that the present condition of the company has been discounted by the downward movement in the stock. A concern having as many ramifications, and being so closely identified with the business world as General Electric must necessarily suffer in a general depression. There are many in the street who believe that 71 is a very low price for 8 per cent. stock. We call the attention of such to the fact that Sugar Common, a 12 per cent. stock, is selling around 82 and 83.

Edison Electric Illuminating was traded in to a very limited extent at 105¼ to 106. This company this week declared the regular quarterly dividend of 1½ per cent., payable August 1. Books close July 16 and reopen August 1.

Western Union showed some weakness under a pressure of long stock, a portion of which is undoubtedly sacrificed by investors who required the money for commercial purposes, and by others who have closed out on loans. It did not go below 80; the maximum was 82, the average 81¼. There was a story in circulation, not generally credited, to the effect that the Vanderbilts were selling the stock and investing the proceeds in Reading. The earnings of the company are said to be satisfactory, although it is believed that business troubles of the country are having their effect. A 5 per cent. industrial stock at 81, at these times, looks a little dear, and were it not for the very strong holdings and the knowledge of that fact, prices would undoubtedly go low. The liquidation in this stock since the panic of 10 weeks ago, as compared with the other industrials, has been light.

In the less active electrical stocks on the New York Exchange there was little or nothing doing. American District Telegraph was bid 48 and held at 50. American Telegraph and Cable bid at 79 and held at 83. The wide difference between the offered and asked prices indicates conclusively the utter lack of a market. Barring Western Union, the other telegraph stocks received no inquiry, and in consequence were not recorded with a bid.

On the Boston Exchange, Bell Telephone, on limited sales, fluctuated considerably, advancing from 182 to 190 and closing at 187½. Erie Telephone jumped from 42 on Thursday to 48 on Friday. New England Telephone was stationary at 54½ to 55. Westinghouse was bid 21½ and held at 23. Fort Wayne Electric was quoted 8¾ bid and 9½ asked.

Central and South American Telegraph has declared a dividend of 1¾ per cent.

It is probable that the market for the ensuing week will be quiet, with a strong undertone and an upward tendency. Indications are that money will work easier, and with that movement transactions will increase in volume, advancing prices. We look for no material improvement within so short a space of time.

New York, July 8.

PERSONAL.

Mr. J. H. Mason, general manager of the Simplex Electrical Company, Boston, was in New York last week.

Mr. A. J. DeCamp, of Philadelphia, passed through New York on his way to Providence the other day.

Mr. J. Norman Bulkley, one of the engineers in the mining department of the General Electric Company, stopped in New York on his way to Scranton, Pa., last week.

Wesleyan University has conferred the degree of LL. D. on Prof. Henry S. Carhart, of the University of Michigan, who was graduated from Wesleyan in the class of '69.

Nelson W. Perry, editor of the *Electrical World*, was married to Miss Marie Englina Bedell, at Brooklyn, on June 28. The ELECTRICAL REVIEW tenders its congratulations to Mr. and Mrs. Perry.

Captain D. R. Vail, of the Harvard boat crew, is the son of Mr. Theo. N. Vail, so widely known in telephone circles and for many years general manager of the American Bell Telephone Company. The young captain, who is 22 years old and weighs 186 pounds, made a valiant fight in the contest with the Yale crew at New London, but the fates were against him and Yale won.

Killingworth Hedges, member of the Institution of Civil Engineers, of London, is making a hasty American tour. He first visited the World's Fair at Chicago, and is now making a trip among Eastern cities. Mr. Hedges is well known to the readers of the ELECTRICAL REVIEW through his electrical writings and inventions of electrical safety and other devices, as well as the carbold bearings which do not require any lubricant, being composed of gas carbon and steatite.

American Electro-Therapeutic Association.

TO THE EDITOR OF ELECTRICAL REVIEW:

The third annual meeting of the American Electro-Therapeutic Association will be held in Chicago, September 12, 13 and 14, at Apollo Hall, Central Music Hall block. Members of the medical profession interested in electro-therapeutics are cordially invited to attend.

AUGUSTIN H. GOELET, M. D., President.
MARGARET A. CLEAVES, M. D., Secretary.

New York, July 8.

European Electrical News.

THE PROPOSED ELECTRIC RAILWAY BETWEEN VIENNA AND BUDAPEST—THE TELEPHONE IN GENEVA—SUBMARINE CABLE STATISTICS FOR 1892—SIMULTANEOUS TELEGRAPHY AND TELEPHONY.

As is well known, the problem of constructing a high speed electric road between Vienna and Budapest has been seriously considered during the past year by several

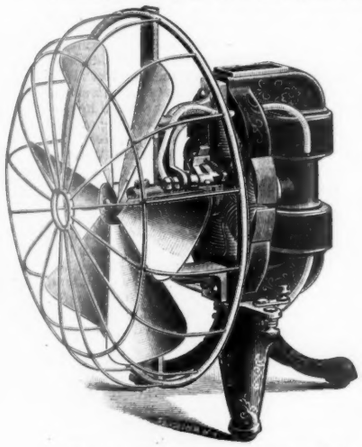


FIG. 1.—THE EDISON BATTERY FAN MOTOR.

eminent electrical engineers. The distance between the two capitals is to be covered in one hour and a half. At first the authorities refused to listen to such a proposition but recently there seems to have taken place a great change of opinion.

Even long prior to this proposed road, electrical engineers have claimed that by means of specially constructed motors and cars, 200 miles an hour may be accomplished. Plans are now being considered for the electrical connection between Paris and Marseilles. It is claimed that by using high speed motors the present running time, *i. e.*, 15 hours, can be reduced to four hours; or, in other words, that the electrical train will make 150 km. per hour.

It will, therefore, be of interest to the readers of the ELECTRICAL REVIEW to have some of the details of the plan recently worked out by the enterprising European electrician, Mr. Zipernowsky, manager of the firm of Ganz & Company.

Mr. Zipernowsky proposes to establish electric connection between Vienna and Budapest by single cars which are to be run every ten minutes, transporting 40 people at a time. The car is to be 45 m. long, 2.15 m. wide, 2.2 m. high, and contains one motor at each end. The car will be without windows, the necessary light being supplied by electricity.

As sources of current he proposes two centrals, each situated 60 km. from Vienna and Budapest. The driving wheels are to be three meters in diameter, the current being taken from the rails by a set of contact wheels. Thence the current is led to the motors which rest upon the axles of the car wheels.

Evidently special means must be employed for the stopping of a train running at such a high speed. On the outside of this car are attached electrical reflectors which, it is claimed, will light up the road for two miles in advance. Mr. Zipernowsky bases his figures upon curves of not less than 3,000 m. radius; but he believes that grades up to 10 per cent. can be overcome without a decrease of speed. The rails are to be 180 mm. high, weighing 50 kg. per running meter; they are laid on cast steel sleepers, which, in turn, are laid on beton. It is recommended to construct the roadbed upon a viaduct and to make the distance between the two tracks 10 meters. Zipernowsky believes 800 horse-power per car to be ample power.

As to expenses, it is stated that such a road will cost about two and a-half times as much as a steam road. Assuming that the average cost of a double track railroad amounts to 400,000 marks per km., the electrical road requires one million marks per km. or 280 million marks for 280 km. At eight per cent. interest, this amounts to 22.4 million marks annually and, adding another 22 million marks for operating expenses, this gives a grand total of 44.4 million marks. Figuring on a fare of 10 marks, the new road must transport 4.4 million passengers annually, or 12,000 daily, but at present the passenger travel between Vienna and Budapest is only 400,000 annually. It is evident that such a road would require a greatly increased passenger traffic in order to become a remunerative enterprise, but it is also apparent that the figures upon which this computation is based, may be considerably modified.

A recent number of *L'Electricien* states that, owing to the decreased rates, the number of telephone lines in Geneva has increased from 61 to 101, while the number of subscribers, which two years ago amounted to 6,224, has nearly doubled. The exchange reports at present 12,595 subscribers, or an increase of 81 per cent. Formerly, the rates were 150 francs per year and the number of communications limited; to-day, the subscriber pays 50 francs for 800 conversations annually. A charge of one sou is made for any additional service, but it is found that 78 per cent of the entire number of subscribers keeps within the prescribed limit.

The French statistician, M. Emile Levasseur, has just issued a set of tables showing the principal telegraph cables of the world and their length in nautical miles. At the beginning of 1892 there existed 1,168 submarine cables, of which 880 were owned by the several States. The total length of these cables is 14,430 nautical miles, while 288 belong to private corporations with a total length of 12,864 nautical miles. Altogether we find 140,344 nautical miles of submarine cable. Of this grand total, France claims 54 cables, or 3,460 nautical miles; Germany, 46 cables, or 1,761 nautical miles; and England, 45 cables, which are divided between several companies. Among these private telegraph corporations, the Eastern Extension, Australasia and China Telegraph Company has 25 cables of 15,831 nautical miles; the Great Northern Telegraph Company, 24 cables of 6,948 nautical miles; the West India and Panama Telegraph Company, 22 cables of 4,557 nautical miles; and the Western and Brazilian Telegraph Company, 15 cables of 5,408 miles. The French Submarine Telegraph Cable Company owns 14 cables with a total length of 3,754 nautical miles.

Referring to an editorial note published in the ELECTRICAL REVIEW for June 10 (p. 206), calling attention to a system of simultaneous telephony and telegraphy recently invented by Mr. Julius von Demetzky, Mr. O. Wehr, in the last issue of the *Elektrotechnische Zeitung*, writes from Vienna, under date of June 9, as follows:

Some time ago several of the electrical papers published an item concerning the invention of a new system of simultaneous telephony and telegraphy, ascribing this invention to Mr. Julius von Demetzky, of Budapest. It was also stated that after a great deal of experimentation Herr von Demetzky had at last succeeded in perfecting his device, and that upon his request the Hungarian Minister granted him permission to test the commercial practicability of the apparatus between Budapest and Szegedin.

Permit me to state that as early as 1885 transportable telephone sets (which may be attached quickly at any point of a telegraph line, whereby simultaneously telephonic and telegraphic messages can be sent) had been first invented and practically used in Austria-Hungary by Mr. Franz Gattinger, chief telegraph inspector of the Austrian railway service. His invention is covered by domestic as well as American patents. Since 1888 his transportable telephone apparatus has been frequently employed in the Austrian railway service in cases of accidents causing an interruption of lines; they have also been used to intercommunicate orally between several stations. It may be of interest to state here that the reproduced sounds are very loud indeed; they can be heard distinctly at a distance of several meters.

On account of the very satisfactory practical results the Austrian Government recommended the introduction of this apparatus to all private railroad corporations doing business within the State. A similar device was invented in Germany by O. Saal, of Erfurt.

From the above it is evident that as to novelty Mr. Julius von Demetzky's invention has no valid claim, and it will be found to differ, not in principle, but merely in details from well known prior devices.

MASON ELECTRIC COMPANY'S PORTABLE PRIMARY BATTERY FAN OUTFIT.—
(See page 264.)

The Edison Battery Fan Motor.

Those who are not so fortunate as to be upon the line of an electric light circuit, and who desire the use of an electric fan, may have their wishes gratified by the purchase of a fan motor run by primary or secondary battery power. The accompanying illustrations show two styles of the well known Edison battery fan motor. This motor, tastily constructed and calculated for the highest efficiency, is intended to be run by four Edison-Lalande primary batteries in porcelain jars enclosed in a polished oak box 25x8x15 inches. This box may, if desired, be put out of the way in any convenient locality, and wires run to the fan which may thus be situated in any available place.

Fig. 2 shows the style known as the Edison ironclad fan motor, and is on a smaller scale than the one before mentioned. But three Edison-Lalande cells are required to run this motor which is perhaps even better adapted for restricted localities. In this motor the bearings are noiseless and self-oiling, and the body is entirely enclosed in an ironclad case which is provided with glass windows at the rear for the regulation of the brushes.

Often there is complaint about primary batteries, due to the noxious fumes which are sometimes set free. In the Edison-Lalande battery the exciting solution is caustic potash, hence there is entire freedom from chlorine and other corrosive fumes. When the battery becomes exhausted the renewal of the parts is a simple matter, they being so constructed that when the battery ceases working, in the types Q and S, all the parts need renewing at the same time. These motors and batteries arranged in outfits are manufactured by the Edison Manufacturing Company of 110 East Twenty-third street, New York.

Summer Homes on the Erie.

The ELECTRICAL REVIEW is indebted to Mr. James Buckley, general eastern passenger agent New York, Lake Erie and Western Railroad, for a handsomely illustrated pamphlet entitled "Summer Homes." Within its covers are presented captivating descriptions and eye-pleasing pictures of the many beautiful summer resorts along the lines of the Erie Railroad. In the language of the author "the balmiest atmosphere, the ruggedest mountains, the purest lakes and rivers, the wildest forests and the highest and healthiest tablelands within easy access of New York city," are to be found on the picturesque Erie lines. This entertaining little pamphlet will be sent free to any one addressing Mr. Buckley at 401 Broadway; and even if the reader is unable to visit the cool spots during the heated weeks, he will find it refreshing to at least learn about them and know that they exist.

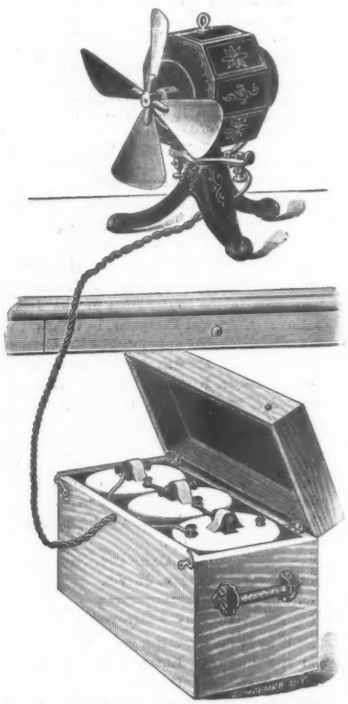


FIG. 2.—THE EDISON IRONCLAD BATTERY FAN MOTOR.

Telephony Versus Electric Traction in England.

FROM OUR LONDON CORRESPONDENT.

A very important question, affecting a large and growing industry, will shortly be taken into consideration by a parliamentary committee. We refer to the conflicting interests as between the electric light and power industry and the telephone service. During the past four years the National Telephone Company, which virtually has a monopoly of the telephone service in the United Kingdom, has opposed in Parliament some fifty bills relating to electric light and power undertakings, and has succeeded in 40 cases in getting clauses inserted in the bills giving protection to the company's telephone system. In the remaining 10 instances, where the promotors of the bills combated the opposition of the telephone company, the results were by no means uniformly favorable to the telephone company. The substance of the protective clauses may be briefly stated as follows:

The electric circuits and works shall be so constructed, and the tramways worked in such a manner as to prevent any injurious interference by induction or otherwise with the electric circuits used or intended to be used by the telephone company, or with the currents in such circuits. Now, the telephone company does not use metallic circuits, but single wires with "earth" return. If it had adopted a twin-wire system, it is possible that no attempt would have been made to get such an obnoxious clause inserted. However, as electric traction on tramways, and especially in the case of the overhead trolley system, cannot very well be governed by electric light regulations, the insertion in electric traction bills of clauses protecting the telephone system—which ought to protect itself by using metallic circuits as other countries do—tends greatly to retard the development of cheap electric traction. It is, therefore, not surprising that those who are concerned in the progress of electricity as a motive power, have formed an electrical traction association to protect this branch of industry.

Quite recently representatives of this association and of the telephone company were received at the Board of Trade to consider the opposing interests. Sir Courtenay Boyle, after hearing both sides, intimated that the fact of having hitherto granted protective clauses did not imply the establishment of a uniform principle that there should be such clauses in favor of the telephone company; that since 1889 a great deal of knowledge had been gained; that the Board of Trade would communicate with Parliament to see whether the matter could be considered and settled, and that in the meantime no protective clauses would be inserted in favor of the telephone company. The result of this is the appointment of a Joint Committee of the Houses of Lords and Commons "to consider and report whether the grant of statutory powers to use electricity ought to be qualified by any prohibition or restriction as to earth return circuits, or by any provisions as to leakage, induction or similar matters, and if so, in what cases and under what conditions? And if the joint committee are of the opinion that any such prohibition, restriction, or provision should be enforced to settle the necessary clauses." Thus it will be noticed that the question to be considered is, in effect, whether the telephone system is to be protected or not.

The joint committee will doubtless sit for several days, and will receive a large amount of evidence from traction, telephone and other interests. In addition to the London County Council, the Association of Municipal Corporations (a body composed of representatives of the local authorities throughout the country) has moved in the matter. This is not surprising when it is remembered that out of the 946 miles of tramways existing in the United Kingdom, no less than 261 miles of lines belong to local authorities. The Association of Municipal Corporations has held two meetings to consider the subject, the last having taken place on the first of June; but beyond the fact that a committee has been appointed to deal with the question generally, and at the meeting of the Joint Parliamentary Committee, nothing is known as to which position or side the association will take up. It is, however, significant that not only were the proceedings kept secret, but also that Sir Albert Rollit, the president of the association, and who occupied the chair at the two meetings, has recently become a director of the telephone company. Still, the members of the electrical industry are not idle, as was shown at an assembly on the 2d of June of the Electrical Section of the London Chamber of Commerce, a section of which the members are representatives of manufacturers and light companies, etc. On that occasion an electric traction sub-committee of the Electrical Section was formed, and the already mentioned Electrical Traction Association was merged into it, so as to have combined action. This sub-committee is constituted with power to raise funds, engage counsel and take such other steps as may be necessary for the advocacy of the protection of traction interests. The committee is powerful, and has power to add to its number.

This, then, is the present position of affairs; and there is no doubt when the Joint Parliamentary Committee meets, that one of the fiercest struggles in the electrical industry of the United Kingdom will commence. On the face of it, it seems that the result of the inquiry will be in favor of the traction interests; but the strong position of the telephone company renders it necessary that all possible support should be given to the electric traction sub committee before the Joint Parliamentary Committee.

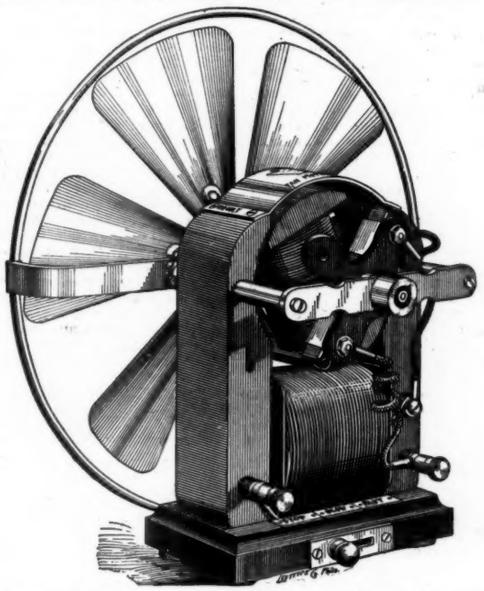


FIG. 1.—NOVELTY ELECTRIC COMPANY'S DIRECT CURRENT FAN MOTOR.

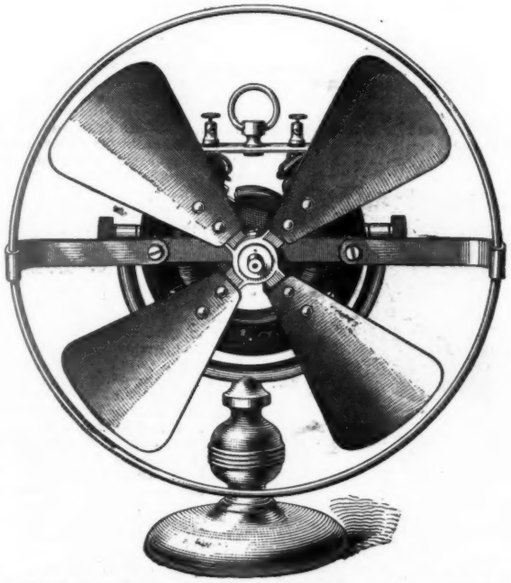


FIG. 2.—NOVELTY ELECTRIC COMPANY'S ALTERNATING CURRENT FAN MOTOR.

The Novelty Electric Company's Fan Motors.

The Novelty Electric Company, 50 North Fourth street, Philadelphia, manufactures the fan motors illustrated in Figs. 1, 2 and 3. These motors are well constructed and handsomely finished, at the same time being moderate in price.

Fig. 1 shows a new direct current 110 volt desk fan motor, which is of acceptable design, runs at high speed and is very efficient. This motor may be run at a slow or fast speed as desired, the change being effected by the switch shown in the base.

An alternating current desk fan motor of the upright type is shown in Fig. 2. This motor is of an especially light design, and consumes only one-half an ampere of current. The alternating motor is adjustable to any position desired, such as is shown in Fig. 3.

The Novelty Electric Company has enjoyed an especially large sale of these motors, which have become popular, not only on account of their moderate price, but because of their efficiency and good wearing qualities.

A Unique Way to Save Rails.

The latest practice in the economy of rolling stock on railways is to turn the cars at the end of each trip, whereby a large percentage of extra wear and tear is saved, says *Iron Age*. Some years ago a portion of the Wabash Railroad was laid with old English iron rails and a small part with steel rails from the Carnegie mills. It became necessary after a time to remove some of the main line rails to another part of the road, and it was observed that after relaying them many gave out immediately, while others manifested no signs of wear. To determine the reason of this apparently unaccountable condition, an investigation was ordered, which showed that the road from which the rails had been removed was built in a northwest-southeast direction, and that in relaying a large number had been turned end for end. Those that had not been so placed exhibited no additional loss by attrition, while the turned rails succumbed in from 30 to 90 days. The conclusion arrived at was that the metal had become polarized from long use, when first laid, and that the fibre was broken up by the traffic in the opposite direction. It was further proved that cast iron wheels generally yielded twice the mileage when the cars were turned at each end of the journey, than when they were run backward and forward without reversing. Notwithstanding the value of this discovery, it was not universally utilized, and it is only recently that some of the American railroads have begun to recognize its importance.

FIG. 3.—NOVELTY ELECTRIC COMPANY'S ALTERNATING CURRENT FAN MOTOR IN INCLINED POSITION.

On Light and Other High Frequency Phenomena.

A LECTURE DELIVERED BEFORE THE FRANKLIN INSTITUTE, AT PHILADELPHIA, FEBRUARY 24, 1893, AND BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT ST. LOUIS, MO., MARCH 1, 1893.

BY NIKOLA TESLA.

(*Concluded from page 258.*)

The experiments with these bulbs seemed to show that the speeds of the projected molecules or particles must be considerable (though quite insignificant when compared with that of light), otherwise it would be difficult to understand how they could traverse a fine metal sieve without being affected, unless it were found that such small particles or atoms cannot be acted upon directly at measureable distances. In regard to the speed of the projected atoms, Lord Kelvin has recently estimated it at about one kilometre a second, or thereabouts, in an ordinary Crookes bulb. As the potentials obtainable with a disruptive discharge coil are much higher than with ordinary coils, the speeds must, of course,

Fig. 32.

TESLA LECTURE.—ELECTROSTATIC ACTION BETWEEN PRIMARY AND SECONDARY, WITH EXTREMELY HIGH FREQUENCIES.

be much greater when the bulbs are lighted from such a coil. Assuming the speed to be as high as five kilometres and uniform through the whole trajectory, as it should be in a very highly exhausted vessel, then, if the alternate electrifications of the electrode would be of a frequency of five million, the greatest distance a particle could get away from the electrode would be one millimetre, and if it could be acted upon directly at that distance, the exchange of electrode matter or of the atoms would be very slow, and there would be practically no bombardment against the bulb. This at least should be so, if the action of an electrode upon the atoms of the residual gas would be such as upon electrified bodies which we can perceive. A hot body inclosed in an exhausted bulb produces always atomatic bombardment, but a hot body has no definite rhythm, for its molecules perform vibrations of all kinds.

If a bulb containing a button or filament be exhausted as high as is possible with the greatest care and by the use of the best artifices, it is often observed that the discharge cannot, at first, break through, but after some time, probably in consequence of some changes within the bulb, the discharge finally passes through and the button is rendered incandescent. In fact, it appears that the higher the degree of exhaustion, the easier is the incandescence produced. There seems to be no other causes to which the incandescence might be attributed in such case, except to the bombardment or similar action of the residual gas, or of particles of matter in general. But if the bulb be exhausted with the greatest care, can these play an important part? Assume the vacuum in the bulb to be tolerably perfect, the great interest then centers in the question: Is the medium which pervades all space continuous or atomic? If atomic, then the heating of a conducting button or filament in an exhausted vessel might be due largely to ether bombardment, and then the heating of a conductor in general, through which currents of high frequency or high potential are passed, must be modified by the behavior of such medium; then also the skin effect, the apparent increase of the ohmic resistance, etc., admit, partially, at least, of a different explanation.

It is certainly more in accordance with many phenomena observed with high frequency currents to hold that all space is pervaded with free atoms, rather than to assume that it is devoid of these, and dark and cold, for so it must be, filled with a continuous medium, since in such there can be neither heat nor light. Is, then, energy transmitted by independent carriers or by the vibration of a continuous medium? This important question is by no means as yet positively answered. But most of the effects which are here considered, especially the light effects, incandescence, or phosphorescence, involve the presence of free atoms, and would be impossible without these.

In regard to the incandescence of a refractory button (or filament) in an exhausted receiver, which has been one of the subjects of this investigation, the chief experiences, which may serve as a guide in constructing such bulbs, may be summed up as follows: 1. The button should be as small as possible, spherical, of a smooth or polished surface and of refractory material, which withstands evaporation best. 2. The support of the button should be very thin, and screened by an aluminum and mica sheet, as I have described on another occasion. 3. The exhaustion of the bulb should be as high as possible. 4. The frequency of the currents should be as high as practicable. 5. The currents should be of a harmonic rise and fall, without sudden interruptions. 6. The heat should be confined to the button by inclosing the same in a small bulb, or otherwise. 7. The space between the walls of the small bulb and the outer globe should be highly exhausted.

Most of the considerations which apply to the incandescence of a solid just considered may likewise be applied to phosphorescence. Indeed, in an exhausted vessel the phosphorescence is, as a rule, primarily excited by the powerful beating of the electrode stream or atoms against the phosphorescent body. Even in many cases where there is no evidence of such a bombardment, I think that phosphorescence is excited by violent impacts of atoms, which are not necessarily thrown off from the electrode, but are acted upon from the same inductively through the medium or through chains of other atoms. That mechanical shocks play an important part in exciting phosphorescence in a bulb may be seen from the following experiment. If a bulb constructed as that illustrated in Fig. 10 be taken and exhausted with the greatest care, so that the discharge cannot pass, the filament *f* acts by electrostatic induction upon the tube *t*, and the latter is set in vibration. If the tube *o* be rather wide, about an inch or so, the filament may be so powerfully vibrated that whenever it hits the glass tube it excites phosphorescence. But the phosphorescence ceases when the filament comes to rest. The vibration can be arrested and again started by varying the frequency of the currents; namely, the filament has its own period of vibration, and if the frequency of the currents is such that there is resonance, it is set easily vibrating, though the potential of the currents be small. I have often observed that the filament in the bulb is destroyed by such mechanical resonance. The filament vibrates, as a rule, so rapidly that it cannot be seen, and the experimenter may at first be mystified. When such an experiment as the one described is carefully performed, the potential of the currents need be extremely small, and for this reason I infer that the phosphorescence is then due to the mechanical shock of the filament against the glass, just as it is produced by striking a loaf of sugar with a knife. The mechanical shock produced by the projected atoms is easily noted when a bulb containing a button is grasped in the hand and the current turned on suddenly. I believe that a bulb could be shattered by observing the conditions of resonance.

In the experiment before cited, it is, of course, open to say that the glass tube upon coming in contact with the filament retains a charge of a certain sign upon the point of contact. If, now, the filament again touches the glass at the same point while it is oppositely charged, the charges equalize under evolution of light. But nothing of importance would be gained by such an explanation. It is unquestionable that the initial charges, given to the atoms or to the glass, play some part in exciting phosphorescence. So, for instance, if a phosphorescent bulb be first excited by a high frequency coil, by connecting it to one of the terminals of the latter, and the degree of luminosity noted, and then the bulb be highly charged from a Holtz machine by attaching it preferably to the positive terminal of the machine, it is found that when the bulb is again connected to the terminal of the high frequency coil, the phosphorescence is far more intense. On another occasion I have considered the possibility of some phosphorescent phenomena in bulbs being produced by the incandescence of an infinitesimal layer on the surface of the phosphorescent body. Certainly, the impacts of the atoms are powerful enough to produce intense incandescence by the collisions, since they bring quickly to a high temperature a body of considerable bulk. If any such effect exists, then the best appliance for producing phosphorescence in a bulb, which we know so far, is a disruptive discharge coil giving an enormous potential with but few fundamental discharges, say 25–30 per second, just enough to produce a continuous impression upon the eye. It is a fact that such a coil excites phosphorescence under most any condition and at all

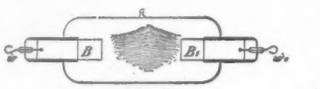


Fig. 33.

TESLA LECTURE.—CARBON DEPOSIT IN TUBE IN A MAGNETIC FIELD.

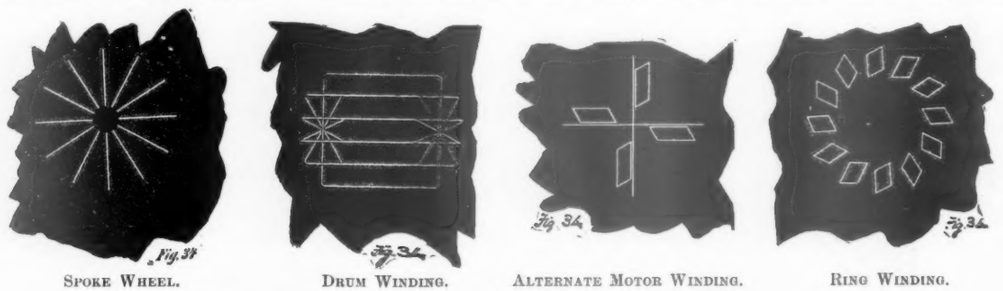
degrees of exhaustion, and I have observed effects which appear to be due to phosphorescence even at ordinary pressures of the atmosphere, when the potentials are extremely high. But if phosphorescent light is produced by the equalization of charges of electrified atoms (whatever this may mean ultimately), then the higher the frequency of the impulses or alternate electrifications, the more economical will be the light production. It is a long known and noteworthy fact that all the phosphorescent bodies are poor conductors of electricity and heat, and that all bodies cease to emit phosphorescent light when they are brought to a certain temperature. Conductors, on the contrary, do not possess this quality. There are but few exceptions to the rule. Carbon is one of them. Becquerel noted that carbon phosphoresces at a certain elevated temperature preceding the dark red. This phenomenon may be easily observed in bulbs provided with a rather large carbon electrode (say a sphere of six millimetres diameter). If the current is turned on after a few seconds, a snow-white film covers the electrode, just before it gets dark red. Similar effects are noted with other conducting bodies, but many scientific men will probably not attribute them to true phosphorescence. Whether true incandescence has anything to do with phosphorescence excited by atomic impact or mechanical shocks still remains to be decided, but it is a fact that all conditions which tend to localize and increase the heating effect at the point of impact, are almost invariably the most favorable for the prodution of phosphorescence. So, if the electrode be very small, which is equivalent to saying in general that the electric density is great, if the potential be high, and if the gas be highly rarefied, all of which things imply high speed of the projected atoms, or matter, and consequently violent impacts—the phosphorescence is very intense. If a bulb provided with a large and small electrode be attached to the terminal of an induction coil, the small electrode excites phosphorescence, while the large one may not do so, because of the smaller electric density, and hence smaller speed of the atoms. A bulb provided with a large electrode may be grasped with the hand while the electrode is connected to the terminal of the coil, and it may not phosphoresce; but if, instead of grasping the bulb with the hand, the same be touched with a pointed wire, the phosphorescence at once spreads through the bulb, because of the great density at the point of contact. With low frequencies it seems that gases of great atomic weight excite more intense phosphorescence than those of smaller weight, as, for instance, hydrogen. With high frequencies the observations are not sufficiently reliable to draw a conclusion. Oxygen, as is well known, produces exceptionally strong effects, which may be, in part, due to chemical action. A bulb, with hydrogen residue, seems to be most easily excited. Electrodes, which are most easily deteriorated, produce more intense phosphorescence in bulbs, but the condition is not permanent, because of the impairing of the vacuum and the deposition of the electrode matter upon the phosphorescent surfaces. Some liquids, as oils, for instance, produce magnificent effects of phosphorescence (or fluorescence?), but they last only a few seconds. So, if a bulb have a trace of oil on the walls and the current is turned on, the phosphorescence only persists for a few moments until the oil is carried away. Of all bodies, so far tried, sulphide of zinc seems to be the most susceptible to phosphorescence. Some samples, obtained through kindness of Professor Henry, in Paris, were employed in many of the bulbs. One of the defects of this sulphide is, that it loses its quality of emitting light when brought to a temperature which is by no means high. It can, therefore, be used only for feeble intensities. An observation which might deserve notice, is, that when violently bombarded from an aluminum electrode it assumes a black color, but, singularly enough, it returns to the original condition when it cools down.

The most important fact arrived at in pursuing investigations in this direction is that in all cases it is necessary, in order to excite phosphorescence with a minimum amount of energy, to observe certain conditions; namely, there is always, no matter what the frequency of the currents, degree of exhaustion and character of the bodies in the bulb, a certain potential (assuming the bulb to be excited with both terminals) which produces the most economical result. If the potential be increased, considerable energy may be wasted without producing any more light, and if it be diminished, then, again, the light production is not as economical. The exact condition under which the best result is obtained seems to depend on many things of a different nature, and it is to be yet investigated by other experimenters, but it will certainly have to be observed when such phosphorescent bulbs are operated, if the best results are to be attained.

Coming now to the most interesting of these phenomena, the incandescence or phosphorescence of gases, at low pressures or at the ordinary pressure of the atmosphere, we must seek the explanation of these phenomena in the same primary causes, that is, in shocks or impacts of the atoms. Just as molecules or atoms beating upon a solid body excite phosphorescence in the same or render it incandescent, so when colliding among themselves they produce similar phenomena. But this is a very insufficient explanation, and concerns only the crude mechanism. Light is produced by vibrations which go on at a rate almost inconceivable. If we compute, from the energy contained in the form of known radiations in a definite space, the force which is necessary to set up such rapid vibrations, we find that though the density of the ether be incomparably smaller than that of any body we know, even hydrogen, the force is something surpassing comprehension. What is this force, which in mechanical measure may amount to thousands of tons per square inch? It is electrostatic force in the light of modern views. It is impossible to conceive how a body of measurable dimensions could be charged to so high a potential that the force would be sufficient to produce these vibrations. Long before any such charge could be imparted to the body it would be shattered into atoms. The sun emits light and heat, and so does an ordinary flame or incandescent filament, but in neither of these can the force be accounted for if it be assumed that it is associated with the body as a whole. Only in one way may we account for it, namely, by identifying it with the atom. An atom is so small, that if it be charged by coming in contact with an electrified body, and the charge be assumed to follow the same law as in the case of bodies of measurable dimensions, it must retain a quantity of electricity which is fully capable of accounting for these forces and tremendous rates of vibration. But the atom behaves singularly in this respect—it always takes the same "charge."

It is very likely that resonant vibration plays a most important part in all manifestations of energy in nature. Throughout space all matter is vibrating, and all rates of vibration are represented, from the lowest musical note to the highest pitch of the chemical rays, hence an atom, or complex

(*Continued on page 272.*)



SPOKE WHEEL. DRUM WINDING. ALTERNATE MOTOR WINDING. RING WINDING.

TESLA LECTURE.—SOME OF THE DESIGNS PRODUCED BY INTERMITTENT DISCHARGES.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Electric Railways.

NORRISTOWN, PA.—The Citizens' Railway Company has increased its capital from $50,000 to $75,000.

NORRISTOWN, PA. — The Montgomery County Railroad Company has increased its capital from $75,000 to $150,000.

CLEVELAND, O.—The Cleveland Cross Town Street Railroad Company has been incorporated with a capital of $10,000.

NORWALK, CONN.—An amendment to the charter of the Norwalk Horse Railway Company empowers the company to double track its line and to use electricity as a motive power.

ONEIDA, N. Y —The Oneida Street Railway Company has applied to the State Railroad Commission for permission to change its motive power to electricity.

CAMBRIDGE, PA.—It is reported that the Cambridge and Edinboro Electric Railway Company will commence work as soon as a franchise is granted.

XENIA, OHIO.—Mr. Wayne Neff, of Cincinnati, representing outside capitalists, is securing right of way for a proposed electric railroad to run from Xenia to Yellow Springs and Springfield.

SPRINGFIELD, MASS.—It looks as though the proposed electric railway line between Springfield and Hartford, Conn., would become a reality. A company has been formed and has secured its franchise, and developments may be expected soon.

CLEVELAND, OHIO.—The West Side and Gordon Park Street Railroad Company has been incorporated with a capital of $10,000.

WACO, TEX.—The Railway Electric Railway and Light Company will issue $250,000 in bonds, the proceeds of the sale to be devoted to bettering the plant and extending the tracks.

WORCESTER, MASS.—The Worcester and Millbury Electric Street Railway Company has increased its capital $150,000. The new increase will be used to pay in full the corporation debt of $128,000, and in the further equipment of the road.

ALTOONA, PA.—The Altoona and Logan Valley Railway Company, which was incorporated for the purpose of constructing an electric railway from Altoona to Hollidaysburg, and from Altoona to Bellewood, has applied for permission to issue $500,000 of five per cent. gold bonds.

ELKHART, IND.—The Thornberger Electric Manufacturing Company; capital, $20,000, has been incorporated by William H. Thornberger, Charles A. Thornberger and John C. Boss.

SAN FRANCISCO, CAL.—The stockholders of the North Beach and Mission Railway Company will vote for the issuance of $2,000,000 worth of bonds. Half this sum will be used in the construction of a modern line in place of the present horse railway system. The line will be changed to an electric or cable road, at an estimated cost of $1,000,000.

Electric Light and Power.

ELMWOOD PLACE, O.—An election will be held in July to vote on a proposition to build a municipal electric light plant.

ROME, N. Y.—In accordance with the recommendation of the special committee in electric lighting, the said committee has been authorized by common council to employ an electric engineer to make surveys, compute cost and prepare plans and specifications for an electric lighting plant.

BALTIMORE, MD.—The McCay-Howard Engineering Company; capital, $3,000. Incorporators, H. Kent McCay, Benjamin C. Howard, A. H. McCay, A. Hambleton Post and Lewis E. Wolf. The company is formed to construct and operate electric light and other plants.

CANANDAIGUA, N. Y.—The name of the Canandaigua Electric Light Company has been changed to the Canandaigua Electric Light and Street Railway Company, and the capital stock has been increased from $50,000 to $80,000.

WESTFIELD, MASS.—An electric plant of large proportions has been projected in Westfield, with the idea of furnishing power and lights throughout Hampden County.

PHILADELPHIA, PA.—The Pentz Reckenzaun Electric Company, of Philadelphia, has been incorporated with a capital of $80,000.

PORTLAND, ORE.—The Portland Heat and Power Company; capital, $500,000. Incorporators, H. Whitenberg, J. T. Baron and D. W. Crowley. The company will operate steam and electrical plants.

ELECTRIC LIGHT FLASHES.

The new electric light plant at Chamberlain, S. D., has been completed and placed in operation. It gives good satisfaction.

The electric light company at New Britain, Conn., are to enlarge their plant, and a new boiler, engine and dynamo will be put in.

Work has begun on the electric light plant at Crisman's mill, at Branchville, N. Y., and the poles for the wires are being delivered.

QUEEN PORTABLE D'ARSONVAL GALVANOMETER.

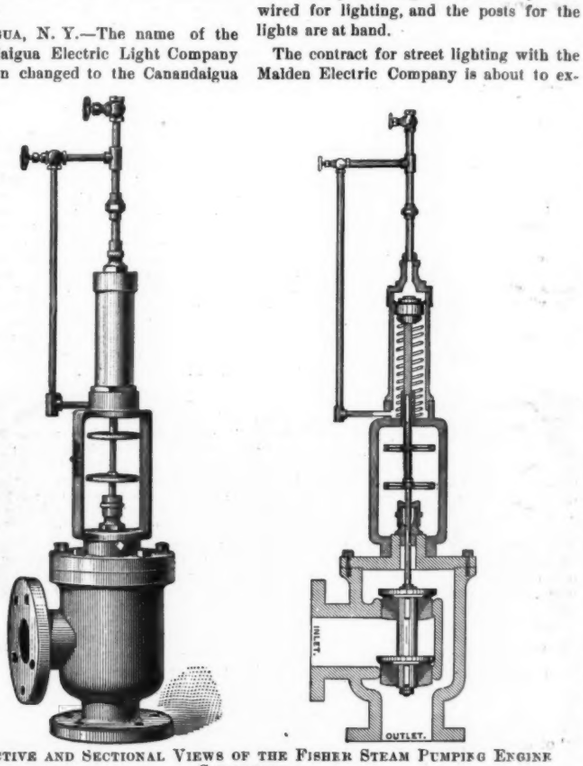
The Elizabeth, N. J., Electric Light Company, who were recently burned out, have constructed a temporary shed, in which they have placed several dynamos.

Work is progressing quite rapidly on the electric light and power plant at Yarmouth, Me. Many buildings have already been wired for lighting, and the posts for the lights are at hand.

The contract for street lighting with the Malden Electric Company is about to expire, and General Manager Bliss is conferring with the selectmen of Malden, Mass., about a new contract.

The city council of Humboldt, TENN., have closed a contract with a company to light the streets with electric lights. The plant will be in full operation in 90 days. Business houses and residences will also be lighted by electricity.

The well at the Salem, Mass., electric light station on Peabody street is now about 370 feet deep. It is intended to go down to 400 feet, and if water is not secured the attempt will probably be abandoned. The rock now being bored through is soft, and it will take about one week more to drill the remaining 30 feet. The water now runs to within 10 feet of the surface.



PERSPECTIVE AND SECTIONAL VIEWS OF THE FISHER STEAM PUMPING ENGINE GOVERNOR.

Queen Portable D'Arsonval Galvanometer.

In completing a line of portable testing instruments Queen & Company, Philadelphia, have placed on the market a D'Arsonval galvanometer as illustrated herewith. It is of the type used heretofore in their testing sets, and is admirably adapted to laboratory or station measurements and for use as a detector of faults in line wire. The index is quite dead beat, so that rapid readings are possible, and because of the principle of construction employed, magnetic fields and mechanical vibrations produce practically no effect.

As the galvanometer is a "zero" instrument, readings cannot be made by direct deflection, but to determine resistance a rheostat and bridge are necessary, exactly as in regular testing sets.

For manufacturing companies, especially where quick work is an item, the above will prove of much value. It is well suited for ascertaining the resistance of carbon filaments for incandescent lamps, and has been used for this purpose by some of the large lamp makers. As a simple ground detector the galvanometer is quite complete in itself, being conveniently mounted in a handsome mahogany case with leather strap.

The Fisher Steam Pumping Engine Governor.

This governor is extremely simple in principle. The valve in the main shell is a double one, the upper disk being the largest, so that there is always an upward pressure upon the valve stem. The upward pressure is resisted by a piston working in a hydraulic cylinder above, and having upon its upper surface the pressure of the main into which the pump is discharging, and which is also resisted in its downward movement by a steel spring below. By means of the lower wheel upon the valve stem in the yoke above the valve casing, which wheel is fastened immovably to the stem, the stem is rotated to the right and screwed up into the bottom of the piston rod, which raises the valve and admits the steam to the steam chest of the pump. When the pressure in the main has accumulated to the desired extent the upper hand wheel upon the valve stem is turned up until it comes in contact with the piston rod of the hydraulic cylinder, where it serves as a lock nut to hold the two rods in this relative position. By this means the valve is unable to lift to an extent which will run the pump at a speed which will maintain more than the pressure at which it is set, while should the pressure drop below this amount the spring beneath the hydraulic plunger and the upward pressure upon the valve will act to open the valve to a greater extent and run the pump at a speed sufficient to maintain the normal pressure. The device is intended to be put upon the valve chest of the pump, between the pump and the throttle valve. The bypass valve in which the angle appears is for the purpose of relieving any pressure above the hydraulic piston when the valve is shut off. The simplicity of the device is apparent at a glance. When the water falls below the point set, by the opening of a valve, or a hydrant, or an automatic sprinkler-head, or any demand for more water, the pressure being less on the hydraulic piston, the steam raises this valve, gradually increases the speed of the pump, and maintains the pressure at the desired point. When the water is not being used, the increased pressure on the hydraulic piston gradually forces the valve to its seat again, which slows up and gradually stops the pump until the pressure falls. It gives a more perfect regulation than it is possible to get by constant care of the throttle, and there can be no over pressure and no damage. The governors are made in 14 sizes, the smaller sizes with screwed and the larger with flanged ends, by the Fisher Governor Company, Marshalltown, Ia.

This company has a fine exhibit located in Machinery Hall at the World's Fair, which is in charge of Mr. E. A. Harris, secretary of the company.

KINDRED INTERESTS

J. H. Bunnell & Company, 76 Cortlandt street, New York, have issued catalogue No. 13, describing and illustrating very complete lines of electric railway, telegraph, telephone and electric light supplies.

The Berlin Iron Bridge Company, of East Berlin, Conn., have received from E. D. Leavitt, consulting engineer of the Calumet and Hecla Mining Company, contract for the iron roof over their new engine house. The building will be 80 feet wide and 200 feet long.

The American Electrical Works, Providence, R. I., again stirred the patriotism of the electrical field by sending out a Fourth of July souvenir in the form of a cannon firecracker, with instructions to celebrate the nation's holiday—and buy all kinds of wire of the American Electrical Works.

Any Information desired in regard to Watch Hill, Narragansett Pier, or any of the famous shore resorts on Narragansett Bay, or the shores of Rhode Island, will be cheerfully given on application by letter or otherwise to general passenger agent Providence and Stonington Steamship Company, New Pier 36, North River, New York, or Providence, R. I.

The Westinghouse Electric and Manufacturing Company have issued a remarkably handsome catalogue of their newest types of electric railway apparatus. Single reduction motors, diverters, controllers, belt-driven and direct-connected generators are fully illustrated and described. It is a catalogue which every one interested should see and have.

The Electric Construction Company, Elkhart, Ind., claim that their new converter is superior to anything now on the market, both in mechanical construction and electrical efficiency. It is possible to remove a burned-out core and replace it with a new one in less than 15 minutes. The company has in hand many orders from the largest central stations in the country.

Through Percy Thompson & Company, investment bankers, New York, the Belt Line Electric Road and the Short Electric Road, of Shreveport, La., have been consolidated and placed under one management. The consolidated securities of this company were sold by this house. The company are now operating 15 miles of road, and propose to extend five miles further.

The Porter Electric Motor Company.—The battery motors made by this company are too well known to require an extensive description. M. D. Porter was the first to realize that the battery motor had a commercial value and was something more than a toy. Having long passed the experimental stage, the original Porter motor is said to be the most efficient of any battery motor in the market. A recent test has shown that the Porter motors, Nos. 1, 2 and 3, require but one cell of battery, two volts, one ampere; No. 4, two cells, two amperes, thus making it an economical motor for the user, as the life of the battery is exhausted very slowly. As no acids are used in their batteries, they are clean to handle, as well as odorless. The cost of running their motors is claimed to be as low as any on the market, and the efficiency from one-third to one-half greater. Their office is at 62 *World* Building, New York, where samples may be seen in operation.

ON LIGHT AND OTHER HIGH FREQUENCY PHENOMENA.

(*Continued from page 270.*)

of atoms, no matter what its period, must find a vibration with which it is in resonance. When we consider the enormous rapidity of the light vibrations, we realize the impossibility of producing such vibrations, directly, with any apparatus of measurable dimensions, and we are driven to the only possible means of attaining the object of setting up waves of light by electrical means and economically, that is, to affect the molecules or atoms of a gas, to cause them to collide and vibrate. We then must ask ourselves: How can free molecules or atoms be affected?

It is a fact that they can be affected by electrostatic force, as is apparent in many of these experiments. By varying the electrostatic force we can agitate the atoms, and cause them to collide under evolution of heat and light. It is not demonstrated beyond doubt that we can affect them otherwise. If a luminous discharge is produced in a closed exhausted tube, do the atoms arrange themselves in obedience to any other but to electrostatic force acting in straight lines from atom to atom? Only recently I investigated the mutual action between two circuits with extreme rates of vibration. When a battery of a few jars (*c c c c*, Fig. 32) is discharged through a primary P of low resistance (the connections being as illustrated in Figs. 19*a*, 19*b* and 19*c*), and the frequency of vibration be many millions, there are great differences of potential between points on the primary not more than a few inches apart. These differences may be 10,000 volts per inch, if not more, taking the maximum value of the electromotive force. The secondary *s* is therefore acted upon by electrostatic induction, which is in such extreme cases of much greater importance than the electrodynamic. To such sudden impulses the primary as well as the secondary are poor conductors, and therefore great differences of potential may be produced by electrostatic induction between adjacent points on the secondary. Then sparks may jump between the wires and streamers become visible in the dark if the light of the discharge through the spark gap *d*, *d*, be carefully excluded. If now we substitute a closed vacuum tube for the metallic secondary *s*, the differences of potential produced in the tube by electrostatic induction from the primary are fully sufficient to excite portions of it; but as the points of certain differences of potential on the primary are not fixed, but are generally constantly changing in position, a luminous band is produced in the tube, apparently not touching the glass, as it should, if the points of maximum and minimum differences of potential were fixed on the primary. I do not exclude the possibility of such a tube being excited only by electrodynamic induction, for very able physicists hold this view; but in my opinion there is as yet no positive proof given that atoms of a gas in a closed tube may arrange themselves in chains under the action of an electromotive impulse produced by electrodynamic induction in the tube. I have been unable so far to produce striæ in a tube, however long, and at whatever degree of exhaustion, that is, staiæ at right angles to the supposed direction of the discharge or the axis of the tube, but I have distinctly observed in a large bulb, in which a wide luminous band was produced by passing a discharge of a battery through a wire surrounding the bulb, a circle of feeble luminosity between two luminous bands, one of which was more intense than the other. Furthermore, with my present experience, I do not think that such a gas discharge, in a closed tube, can vibrate, that is, vibrate as a whole. I am convinced that no discharge through a gas can vibrate. The atoms of a gas behave very curiously in respect to sudden electric impulses. The gas does not seem to possess any appreciable inertia to such impulses, for it is a fact, that the higher the frequency of the impulses, with the greater freedom does the discharge pass through the gas. If the gas possesses no inertia then it cannot vibrate, for some inertia is necessary for the free vibration. I conclude from this that if a lightning discharge occurs between two clouds, there can be no oscillation, such as would be expected, considering the capacity of the clouds. But if the lightning discharge strike the earth, there is always vibration—in the earth, but not in the cloud. In a gas discharge, each atom vibrates at its own rate, but there is no vibration of the conducting gaseous mass as a whole. This is an important consideration in the great problem of producing light economically, for it teaches us that to reach this result we must use impulses of very high frequency, and necessarily also of high potential. It is a fact that oxygen produces a more intense light in a tube. Is it because oxygen atoms possess some inertia and the vibration does not die out instantly? But then nitrogen should be as good, and chlorine and vapors of many other bodies much better than oxygen, unless the magnetic properties of the latter enter prominently into play. Or is the process in the tube of an electrolytic nature? Many observations certainly speak for it, the most important being that matter is always carried away from the electrodes, and the vacuum in a bulb cannot be permanently maintained. If such process takes place in reality, then again must we take refuge to high frequencies, for with such, electrolytic action should be reduced to a minimum, if not rendered entirely impossible. It is an undeniable fact that with very high frequencies, provided the impulses be of a harmonic nature, like those obtained from an alternator, there is less deterioration and the vacua are more permanent. With disruptive discharge coils there are sudden rises of potential and the vacua are more quickly impaired, for the electrodes are deteriorated in a very short time. It was observed in some large tubes, which were provided with heavy carbon blocks B B_1, connected to platinum wires w w_1 (as illustrated in Fig. 33), and which were employed in experiments with the disruptive discharge instead of the ordinary air gap, that the carbon particles under the action of the powerful magnetic field in which the tube was placed, were deposited in regular fine lines in the middle of the tube, as illustrated. These lines were attributed to the deflection or distortion of the discharge by the magnetic field, but why the deposit occurred principally where the field was most intense did not appear quite clear. A fact of interest, likewise noted, was that the presence of a strong magnetic field increases the deterioration of the electrodes, probably by reason of the rapid interruptions it produces, whereby there is actually a higher electromotive force maintained between the electrodes.

Much would remain to be said about the luminous effects produced in gases at low or ordinary pressures. With the present experiences before us we cannot say that the essential nature of these charming phenomena is sufficiently known. But investigations in this direction are being pushed with exceptional ardor. Every line of scientific pursuit has its fascinations, but electrical investigation appears to possess a peculiar attraction, for there is no experiment or observation of any kind in the domain of this wonderful science which would not forcibly appeal to us. Yet to me it seems that of all the many marvelous things we observe, a vacuum tube, excited by an electric impulse from a distant source, bursting forth out of the darkness and illuminating the room with its beautiful light, is as lovely a phenomenon as can greet our eyes. More interesting still it appears when, reducing the fundamental discharges across the gap to a very small number, and waving the tube about, we produce all kinds of designs in luminous lines. So, by way of amusement, I take a straight long tube, or a square one, or a square attached to a straight tube, and by whirling them about in the hand, I imitate the spokes of a wheel, a Gramme winding, a drum winding, an alternate current motor winding, etc. (Fig. 34). Viewed from a distance the effect is weak and much of its beauty is lost, but being near or holding the tube in the hand, one cannot resist its charm.

In presenting these insignificant results I have not attempted to arrange and co-ordinate them, as would be proper in a strictly scientific investigation, in which every succeeding result should be a logical sequence of the preceding, so that it might be guessed in advance by the careful reader or attentive listener. I have preferred to concentrate my energies chiefly upon advancing novel facts or ideas which might serve as suggestions to others, and this may serve as an excuse for the lack of harmony. The explanations of the phenomena have been given in good faith and in the spirit of a student prepared to find that they admit of a better interpretation. There can be no great harm in a student taking an erroneous view, but when great minds err, the world must dearly pay for their mistakes.

LITERARY.

"How Distrust Stops Trade" is the title of an article by Edward Atkinson, the well-known economist, that appears in the *North American Review* for July.

The Review of Reviews, the most interesting and broadest of all magazines, continues to grow better with each issue. The number for July is especially interesting as it contains articles on Thomas A. Edison, Sir William Thomson (Lord Kelvin), and electricity at the World's Fair.

We have received a copy of the latest catalogue of the American Institute of Electrical Engineers, revised to July 1. It embraces some new features, among them the geographical distribution, a calendar of meetings, the rules, and an imprint of the badge. Copies will be mailed to members, or others, upon application, either from the World's Fair or the New York headquarters of the Institute, 12 West Thirty-first street.

"Portative Electricity," by J. T. Niblett; 234 pp., 90 illustrations. Biggs & Company, London. Price, $1. Supplied by the ELECTRICAL REVIEW Publishing Company, 13 Park Row, New York.

This is a treatise on the application, methods of construction and the management of portable secondary batteries. The aim is to point out some of the numerous purposes to which portative electricity is now lending itself, and to explain the principles involved. The book is not intended for the use of electrical engineers, but rather for users of storage batteries. The treatment of the subject is popular.

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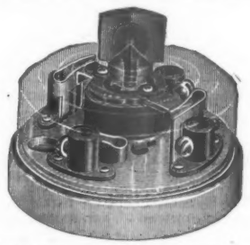

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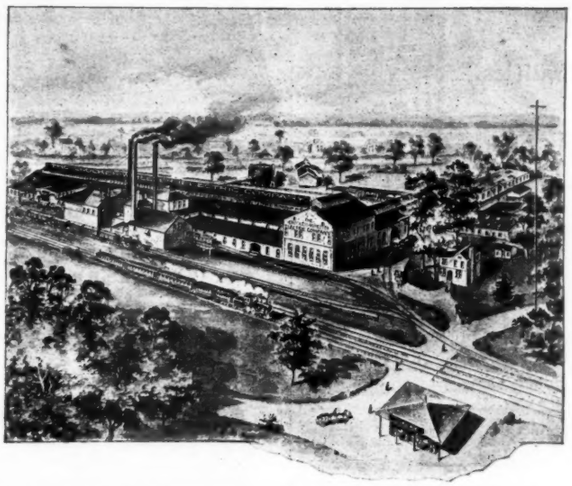

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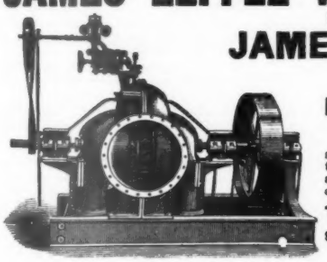

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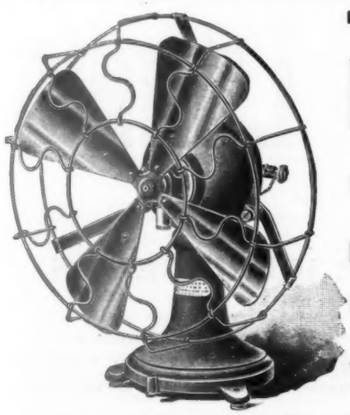

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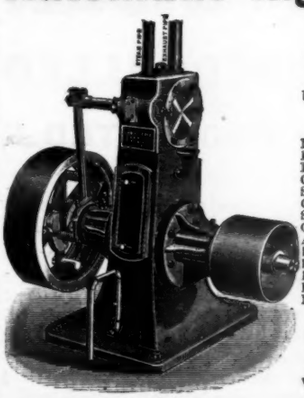

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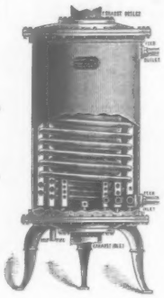

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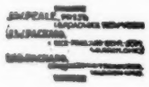

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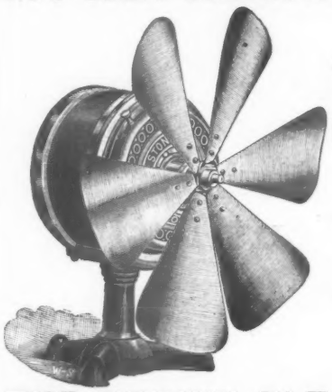

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